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About the Author

Lyndon A. Peer, M.D., is clinical and research director of the Rehabilitation Center for Plastic and Reconstructive Surgery at St. Barnabas Hospital, Newark, New Jersey. The inventor of diced cartilage grafts, he originated the principle of introducing them into perforated vitallium molds to preform or shape the cartilage.

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Detailed information and literature supplied on request.

1. Bryson, K. D.: American Surgeon, Vol. 20, p. 751, July 1954.
2. Lumpkin, W. R. and Firor, W. M.: American Surgeon, Vol. 20, p. 756, July 1954.

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THE
AMERICAN
SURGEON

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THE KINETIC SYSTEM AND ITS CONTROL: TWENTY-FIVE YEARS AFTER

GEORGE CRILE, JR., M.D.

Cleveland, Ohio

Time and again in the long course of history great truths have been found, forgotten and sometimes found again.

Twenty-five years ago, my father spoke on this same program and at that time he said,

"I wish to call to your attention the fact that there are only certain organs of the body that are immediately essential to the carrying on of life. These are the brain and autonomic nervous system, the adrenal glands, and the thyroid gland, organs that by cooperation with each other, are essential to the work that man performs—a group that constitutes the controlling system of man in all his vicissitudes. In health and disease, in his emotional and his intellectual life, in his work and his play, in combating an infection, in seeking a mate, in fight or in flight, in peace or in war, this system of energy-transformation is ceaselessly at work."

This philosophy, expressed by Doctor Crile in 1931, was one which he had developed gradually since the turn of the century when he, and Doctor Cannon working independently, developed their theory of the emergency action of the adrenal glands. The theory was widely accepted in its day; fell into some degree of disuse, and then was renamed by Selye "The adaptation syndrome." Figure 1 published by Doctor Crile in 1907, showed histologic changes of the adrenal cortex in response to stress. Doctor Crile was well aware of the role of the adrenal cortex in living processes.

Twenty-five years ago, Doctor Crile said, "The emotions of fear, worry, hate and jealousy affect every organ and every cell of the body. Some organs are

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stimulated, some are inhibited, all are disturbed. The foundations of certain characteristically human diseases are laid, not only human diseases but diseases that are found principally or wholly in the superior human beings and in those who have the greatest capacity and the greatest urge for work and worry, those who, whatever their capacity, take life seriously, whose kind have made civilization what it is and who now bear its burden." In such patients, Doctor Crile said, "Physicians recognize a group of diseases, acute and chronic, that may be classified as overwork or wear-and-tear diseases. Among these are hypertension, exophthalmic goiter and peptic ulcer."

Compare these remarks to those of Selye 20 years later. "Three diseases stand out as striking and universally acknowledged examples of stress casualties; thyrotoxicosis, duodenal ulcer and nonrenal hypertension."

Doctor Crile did his first adrenalectomy for hypertension in 1913; he first denervated the adrenals for hyperthyroidism in 1917; and he did his first denervation for peptic ulcer in the late nineteen twenties.

What happened to the patients treated by adrenalectomy, by adrenal denervation, and later by splanchnic section and resection of the celiac ganglion? The answer to this question is a fascinating study that involves psychology as much as physiology. The factor that made the results of these operations so difficult to evaluate was the force of Doctor Crile's personality. This force gave Doctor Crile's patients implicit confidence in him and in the operations that he performed. If certain diseases of civilized man are indeed the result of the anxieties of modern life, it is likely that a strong suggestion of cure would of itself be partly curative. Having myself seen thousands of Doctor Crile's patients, some of whom still return, I can assure you that most of them consider themselves to have been cured or vastly improved. Nevertheless, sustained objective evidence of improvement following adrenal denervation was lacking except in some of the functional disorders such as neurocirculatory asthenia. There were few if any patients with hypertension in whom the blood pressure was permanently lowered, and I did not see an active duodenal ulcer which healed, or clear-cut hyperthyroidism that was controlled by operations on the adrenals. Doctor Crile's treatment of the diseases of civilization, although satisfactory in his hands, could not be duplicated by others. In the light of history, the direct attack on the adrenal sympathetic system has not been satisfactory.

If Doctor Crile's treatment of the "*diseases of civilization*" was wrong, what is the correct treatment and what advances have been made in this field? We have seen the rise and fall of surgery of the sympathetic nervous system applied to the control of essential hypertension. From removal of one adrenal Doctor Crile went to denervation of both, then to denervation of the adrenals and section of the splanchnic nerves and finally to celiac ganglionectomy, always with increasing success in moderating the patients' symptoms and with increasing temporary control of the hypertension. Usually, however, the hypertension returned and the course of the disease, measured by objective criteria, did not seem to be affected.

Others carried on from where Doctor Crile left off and extended the attack

by adding lumbodorsal sympathectomy and finally even complete sympathectomy. Despite favorable initial results and in some cases prolonged remissions of hypertension, sympathectomy never gained universal acceptance. The trouble was that no one could select the patients who would react well.

Side by side with the improving surgical technics came advances in the medical treatment of vascular disease and the introduction of a host of new drugs—reserpine, hexamethonium, apresoline and others, each of which took its place in the control of both the symptoms of high blood pressure and of the pressure itself. So it has come to pass that the surgical treatment of hypertension which, when it was introduced caused such a storm of protest, developed, despite all opposition, into a rich maturity and then declined again into senescence. Now the cycle is complete, surgery is no longer in vogue in the treatment of hypertensive disease.

In the past decade and a half there has been a great change in the treatment of hyperthyroidism. "Exophthalmic goiter," as Doctor Crile knew it, was a challenge to the surgeon—a battle against a profound disorder of the patient's physiology. Then there came iodine and the great era of safe surgery of the thyroid. Next there was thiouracil and a decade devoted to attempting a medical cure of the disease. Now we are living in the atomic era, when more and more patients with hyperthyroidism are being treated with I^{131}. Strangely enough, although Doctor Crile was a surgeon at heart, I am sure that if he were alive today he would be as thrilled and unbelieving as we are when we see the daily repeated miracle of I^{131}—great glands melting away with a single treatment; bedridden patients who have cardiac disease recovering and returning to work; hyperthyroidism recurrent after operation, the type for which Doctor Crile employed denervation of the adrenals, now controlled in a few weeks by the patient's taking a capsule or drinking what seems to be a glass of water. There is no question that from the standpoint of economy, comfort, completeness of control, and absence of side effects, radioactive iodine is superior to subtotal thyroidectomy. To date there is no evidence that therapy with I^{131} is carcinogenic, and unless the next decade of our experiences reverses the impression of the past I do not doubt that all patients with Graves' disease, regardless of age, will be treated with I^{131}. Patients with nodular goiter present a different problem and for years to come the majority will continue to be treated by thyroidectomy.

Doctor Crile was disappointed in the results of adrenal surgery for peptic ulcer and before long abandoned this method of attack. Despite this defeat, he was convinced that ulcer was a psychosomatic disease related to worry and stress, and controllable by an attack on the autonomic nervous system. He was right, but he was working on the wrong side of the system. It remained for Dragstedt to emphasize the effect of parasympathetic stimulation on gastric secretion and to control duodenal ulcer by severing the vagus nerves. Doctor Crile would have cheered if he could have known of Dragstedt's researches. The philosophy of the attack was identical to his own.

What is the present status of vagotomy? This operation too has gone through a cycle. At first it was accepted with enthusiasm. Soon the intolerable effects

of gastric retention were apparent, and then a high incidence of recurrent ulceration was reported. But marginal ulcers did well after vagotomy and in order to reproduce this situation and avoid gastric retention, gastroenterostomy was added to vagotomy to drain the denervated stomach.

The place of gastroenterostomy and vagotomy in the treatment of duodenal ulcer still is a matter of debate. It has been established that a gastroenterostomy that is placed high in the stomach predisposes both to gastric retention and to recurrence of ulceration. Food retained in the antrum by a stomach which does not empty promptly causes chemical stimulation of the antrum and this in turn through the endocrine activity of the antrum stimulates hypersecretion of acid and enzymes.

Some surgeons have had bad results with gastroenterostomy and vagotomy and others have had good results. Those who place the gastroenterostomy dependently and near the pylorus have little or no difficulty with gastric retention and have had a low incidence of recurrent ulceration. Those who place the gastroenterostomy high, or obliquely, or who invert an exceptionally wide cuff may have a high incidence of gastric retention and a high rate of recurrence. The end results of the operation depend also on the thoroughness of the denervation of the stomach. Since the completeness of the operation increases with the experience of the surgeon, it is small wonder that the end results in small series of cases often are unsatisfactory.

Our own experience with vagotomy and gastroenterostomy during the past 9 years has been satisfactory. Ninety-five per cent of the first 156 patients operated upon for duodenal ulcer have now been followed from 5 to 9 years. Eight per cent have had demonstrable recurrences of ulceration, and another 9 per cent, in the absence of demonstrable recurrence, have had either a single episode of bleeding or have had periods of ulcerlike distress requiring medicine or a special diet.

Only 5 per cent of these 156 patients have required secondary operations for jejunal ulcer. The results of the secondary resections have been uniformly satisfactory, and the failures of gastroenterostomy and vagotomy have been correctible failures. These results compare favorably with our previous experience with two-thirds gastric resection and with reports in the literature in which the follow-up usually is much shorter and less complete.

In our entire experience with 556 vagotomies and gastroenterostomies there have been only 2 deaths in the hospital after operations—a mortality rate of 0.36 per cent. This mortality rate is less than one-fifth of that we would have anticipated if we had resected the stomachs of all of these patients. Since ulcer does not often threaten life, safety is the most important consideration in its treatment—safety, and the certainty that operation will not produce permanent and irreparable damage such as often is seen as a side effect of radical resections.

Despite the fact that vagotomy with gastroenterostomy is far from a perfect cure of ulcer, the safety of the operation, both from the standpoint of mortality and morbidity, is well established. Five to 9 years after operation, 81 per cent of the patients are well and working and free of ulcer disease. From the standpoint of ulcer cure, this record compares favorably with that of the two-thirds

resection and if morbidity and mortality are considered, it is a better record than made by the four-fifths to seven-eighths gastrectomy.

If nervous stimuli were the only factors that stimulate the production of gastric acidity, vagotomy with gastroenterostomy would be the final answer to the problem of duodenal ulcer. Unhappily, the problem is not so simple as this, for the gastric antrum also plays a part in the secretory mechanism of the stomach. Since both the vagus and the antrum are important, the most physiologic approach to the problem of duodenal ulcer would be an operation which removed both the nervous and the hormonal stimuli. It is this operation—vagotomy and hemigastrectomy—that I would like to discuss.

Johnson and Orr of England have done vagotomies and hemigastrectomies on a series of 405 patients with duodenal ulcer and have followed these patients for up to 7 years following operation. There have been no recurrences of the ulcers in this group and the side effects are few. The mortality rate was just under 2 per cent. If it were not for the fact that in certain cases difficulties in dealing with the duodenal stump increase the risk of gastric resection, vagotomy and hemigastrectomy would be an ideal operation for duodenal ulcer.

Our own experience with vagotomy and hemigastrectomy extends over a period of 2 years and includes 123 cases. In this series there have been no recurrences of symptoms or signs of ulcer, no incapacitating side effects and only 1 postoperative death.

The 123 patients subjected to vagotomy and hemigastrectomy do not represent a consecutive series. They have been selected for this operation. Vagotomy with gastroenterostomy was done in all patients in whom penetration of the ulcer, inflammation or obesity increased the hazards of resection. Seventy per cent of the patients have been treated by resection with vagotomy and 30 per cent by gastroenterostomy with vagotomy. We hope that by selecting the operation to suit the individual patient we will be able to maintain a mortality rate of less than 0.5 per cent and at the same time decrease the number of recurrent ulcers.

We are not alone in our growing appreciation of the value of vagotomy. Surgeons throughout the country are turning more and more to vagotomy with gastroenterostomy in the patients in whom resection is difficult or dangerous. There is, moreover, a widespread dissatisfaction with the end results of the radical gastrectomy and its sometimes tragic side effects. For these reasons vagotomy, after reaching a low ebb in the first year or two of this decade, again is on the upturn and now is being used increasingly in conjunction with resection of the antrum. So do the cycles run their course.

Have we of the medical profession always run in circles? If we consider the problem of cancer of the breast, it makes us wonder if we really are getting anywhere. Fifty years ago, in the days of Halsted, it was thought that radical mastectomy was the final answer to the surgery of breast cancer. In the short span of our medical generation we have seen this concept totter and threaten to fall. It is under attack on the one side by the proponents of the super-radical operation and on the other by the advocates of simple mastectomy and radiation therapy. How discouraging, when after 50 years of surgical experience with the com-

monest cancer of the body we cannot make up our minds whether or not surgery is of curative value in its treatment.

If all of medical treatment were as disheartening as is that for cancer of the breast, we would have little incentive to carry on. Fortunately, however, in the diseases of the kinetic system the situation is more encouraging. No longer does malignant hypertension inexorably pound the patients' vessels to death. Although the secret of degenerative disease of arteries is not yet manifest, hypertension itself usually can be controlled.

Despite the fact that the cause of Graves' disease still is a mystery, magnificent achievements have been made both in the prevention and in the nonsurgical control of many disorders of the thyroid. Surgical removal of an organ is an admission of defeat—an acknowledgment that we have failed to understand or control the pathologic process that made the operation necessary. More and more of the problems of the thyroid are being solved prophylactically or by treatments which do not involve surgical removal of the gland. We are winning the battle of the thyroid.

Finally consider the progress that has been made in the field of peptic ulcer; the increased understanding of the differences between duodenal and gastric ulcers; the improved medical control of hyperacidity; the new physiologic attacks upon the secretory mechanisms of the stomach. Here real progress has been made. Research is leading us not in circles, but straight to the heart of a problem.

Thirty years ago, Doctor Crile predicted that the understanding and control of diseases of the kinetic system would come through control of pathologic physiology. This prediction has come true and I am sure that if Doctor Crile were here today he would view with pride the accomplishments of the generation that he did so much to inspire.

I cannot forbear, in closing, to read a note that my father's associate, Doctor Dinsmore, appended to this manuscript. "As I read the foregoing, I could not help remembering the opinionated viewpoint of the writer as a medical student and a resident, and the arguments that took place between father and son. Of course, the father knew that in due course the son would look back, realize the folly of arguments and agree with him."

Another medical cycle completed!

CANCER OF THE LUNG*

O. C. Brantigan, M.D., and C. Y. Hadidian, M.D.

Baltimore, Md.

There can be little doubt that cancer of the lung is encountered more frequently now than formerly. Whether this is the result of an increasing awareness of the medical profession of the problem, the aging and increase in our population, or an actual increase in the incidence does not materially lessen the magnitude of the problem. Adler[1], in 1912, in a complete study of the disease and a survey of the literature, could find only 374 authentic recorded cases of cancer of the lung, whereas this article deals with 345 patients seen in the private practice of one physician. This report brings up to date the series previously reported.[4, 5, 6, 7]

The recorded death rate from cancer of the lung in Baltimore City was 101 in 1940, 200 in 1950, and 240 in 1953 (table 1).[13] At Baltimore City Hospitals there were 1591 general admissions in 1920 and among these a diagnosis of cancer of the lung was made in 2 instances. In 1940 there were 8532 general admissions and cancer of the lung was diagnosed in 26 patients. In 1950, of 7322 general admissions, there were 28 diagnoses of this condition. In 1953 the admissions totalled 8284 and cancer of the lung was diagnosed 27 times. At the University Hospital in Baltimore during 1940 there were 9289 general admissions and a diagnosis of cancer of the lung was made in 10 patients. In 1950 there were 11,772 general admissions and 43 instances of cancer of the lung. Of 12,963 general admissions in 1953 cancer of the lung was diagnosed in 72 patients.

There is no doubt that awareness of the problem by the profession accounts for more accurate diagnosis. It is easy to understand how in the past a lesion could be overlooked upon examination of a pathologic specimen in which perhaps 10 per cent of the lesion was cancerous and 90 per cent noncancerous (fig. 1). The latter changes are the result of infection and obstruction distal to the actual growth. Unquestionably more people now are living to an age where they have a chance of developing cancer of the lung. At the turn of the century 4.1 per cent of the American population was over 65 years of age. By 1920, although the total population had increased by almost 30,000,000, only 4.3 per cent were over 65 years of age. In the ensuing 30 years the proportion of the population over the age of 65 almost doubled to reach the 1950 figure of 8.2 per cent.[8] It is estimated that by 1970 the number of people 65 years old or over will again double itself. If all other factors involved in carcinoma of the lung remain constant the aging of the population will bring about a twofold increase in the incidence of the disease. This is a most discouraging prediction but it serves to emphasize the magnitude and seriousness of the disease. The death rate for cancer of the lung in the United States rose from 5.3 per 100,000 in

* From the Department of Surgery, University of Maryland School of Medicine.
Presented during the Atlanta assembly of The Southeastern Surgical Congress, Feb. 21–24, 1955.

TABLE 1

Resident deaths from respiratory cancer, Baltimore City, 1936–1953

Year	Resident Deaths Respiratory Cancer*	Estimated Population	White Deaths	Nonwhite Deaths	Estimated White Population	Estimated Nonwhite Population
1953	240	963,500	190	50	715,800	247,700
1952	236	962,300	195	41	721,400	240,900
1951	208	954,800	175	33	721,400	233,400
1950	200	950,000	167	33	723,000	227,000
1949	211	947,000	178	33	727,300	219,700
1948	185	943,000	159	26	729,000	214,000
1947	181	938,000	151	30	729,800	208,200
1946	168	933,000	145	23	730,500	202,500
1945	161	930,000	132	29	732,800	197,200
1944	159	937,000	136	23	743,000	194,000
1943	140	963,000	119	21	769,000	194,000
1942	129	936,000	115	14	754,400	181,600
1941	131	866,000	108	23	698,000	168,000
1940	101	860,456	88	13	693,268	167,188
1939	91	855,033	82	9	690,318	164,715
1938	97	849,610	87	10	687,348	162,262
1937	107	844,187	94	13	684,361	159,826
1936	89	838,764	76	13	681,356	157,408

* 1936–1939—Code 47, 4th Revision, International Classification of Causes of Death. 1940–1949—Code 47, 5th Revision, International Classification of Causes of Death. 1950, 161–163, 6th Revision, International Classification of Causes of Death.

1930 to 27.1 per 100,000 in 1948, whereas cancer other than in the lung among white males increased from 152.1 in 1930 to 165.2 in 1948.[15]

ETIOLOGY

The etiology of cancer anywhere in the body is obscure. In some locations it definitely is linked to sex, as in the breast. The practical absence of melanotic sarcoma before puberty and in the castrated male or female is another example of sex-linked cancer.[10] In the present series the ratio among men and women is 13 to 1, which strongly suggests a sex connection. Hueper[16] reported that sex incidence varies according to geographic locations, 2 to 1 in Sweden and 20 to 1 in sections of the United States. In the group recorded here there were 40 women; 20 or 50 per cent were inoperable and were not explored. Twenty were explored; 7 were not resectable, whereas 13 were resected and 3 of these died in the hospital. Of 5 who might have lived five years or longer none survived that length of time. Only 3 of the group are now living—41, 31 and 21 months post-operatively—and all are free of disease.

Cigarette smoking has been accused of causing the great increase in incidence of lung cancer. Hammond[15] wrote that cigarette smoking increased 456 per cent from 1920 to 1953 and the incidence of lung cancer showed an increase of 411 per cent from 1930 to 1948. Wynder[24] proved that condensed cigarette tar could

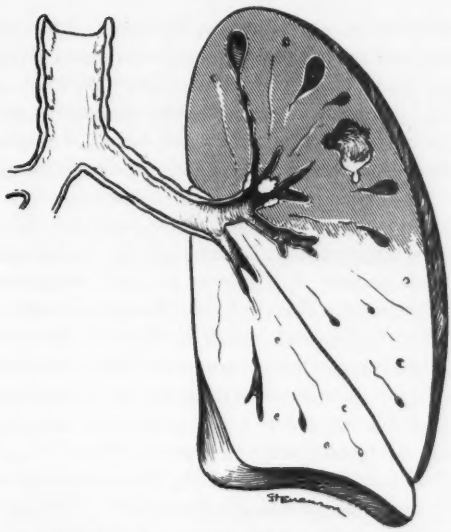

FIG. 1. The drawing shows a small cancer involving the posterior, apical and anterior segments of the upper lobe of the left lung. There is interference with the physiology of air flow and drainage of secretions. The result may be atelectasis, parenchymal infection and/or bronchiectasis, abscess formation or other destructive phenomenon in the involved area. Obviously the tumor when small and without metastasis produces no systemic symptoms or reaction. It would not be detected by roentgenographic study of the chest. When infection occurs distal to the tumor a relatively large area of lung parenchyma will be involved. The inflammatory reaction will cause systemic reaction, symptoms, and will produce roentgenographic change. The symptoms and changes in the roentgenogram are not from the cancer but from a complication. The symptoms may subside completely and the chest roentgenogram return to normal and yet through all this there has been no real change in the cancer. It is easy to understand how years ago clinicians and pathologists failed to recognize a small cancerous lesion when complicating pathology made up 80 to 95 per cent of the disease.

produce carcinoma in the epidermis of a specific strain of mouse. Hueper[16] thought that the experimental production of cancer of the lung by cigarette smoke or its by-products has failed. It is obvious that the sex ratio in cancer of the lung and cigarette smoking is not directly proportional. Doll,[11] in an exhaustive study, believed there was some association between cigarette smoking and cancer of the lung, but no specific agent in tobacco has been found responsible. In the present series no evidence has been brought to bear upon the problem of cigarette smoking and cancer of the lung. It is evident that constituents other than those inhaled may be responsible for the increased incidence of lung cancer. Some agents absorbed by the skin or gastrointestinal tract may be involved. There has been a tremendous increase in the use of certain drugs. Generally, people in the United States are living farther from the source of their food supply. In preserving and transporting food some necessary elements may be lost. Metabolic or chemical agents excreted by the respiratory tract may be causally related since the sulfonamides and other drugs are excreted by the bronchial glands.

There seems little doubt, according to Machle,[18] that American chromate workers develop cancer of the lung 16 times more frequently than the anticipated rate. In the present series there were 4 patients who were chromate workers. One patient refused operation. Three accepted operation and in each the lung and mediastinal glands were removed. Each survived operation and all are living and free of disease at this time—54, 20, and 19 months postoperatively.

PATHOLOGY

Since the lungs originate from a common site by a budding process from the primitive gastrointestinal tract, it is easy to group all lung cancers as variations of one basic type of neoplasm. This probably accounts for the change seen in one case from an undifferentiated lung cancer by biopsy before roentgen ray treatment to a completely differentiated squamous cell type at autopsy after roentgen ray therapy. The alveolar cell type should cause no consternation since, according to Miller,[20] the alveolar lining cell is a non-nucleated epithelial cell. Engelman[12] in the study of 234 autopsies believed that epidermoid and undifferentiated forms arose from the basal cell layer of the bronchial epithelium and adenocarcinoma from the bronchial glands. He detected no alveolar cell carcinoma. He also found 61.6 per cent epidermoid carcinoma, 8.9 per cent adenocarcinoma, and 29.01 per cent undifferentiated. Of the 126 resected cases in the present series there were 65.7 per cent epidermoid (squamous), 13.4 per cent adenocarcinoma. McGrath[19] called attention to the multiple sites of origin of cancer in a single lung. This undoubtedly accounts for 1 patient in the series who at the time of lung resection had a squamous cell tumor in the upper lobe and an adenocarcinoma in the lower lobe.

The epidermoid and the undifferentiated tumors most likely are to be located in the central portion of the lung and adenocarcinoma is found in the parenchyma or periphery of the lung. However, this is by no means always true. The undifferentiated carcinoma of the lung generally is thought to be the most malignant type. It generally is recognized that some lung cancers remain localized and invade locally, whereas others apparently metastasize widely with no signs of local invasion. Obviously the latter group is far more dangerous to the patient.

SYMPTOMS AND DIAGNOSIS

Symptoms of carcinoma of the lung are extremely variable. In the beginning they usually are absent. When the growth becomes large enough to produce a change in the physiology of the lung then symptoms will develop from a change in the physiology or the change in physiology will bring about a complication with symptoms which will overshadow the original lesion. For example, wheezing may be the first sign caused by interference with ventilation; however, the interference with ventilation may proceed to complete obstruction and a sudden lobar or lung atelectasis which may cause pain and dyspnea. Infection as a complication of partial or complete bronchial obstruction may occur and cause cough and fever. The symptoms may, therefore, be the result of the complication and not of the cancerous lesion. The complication may subside and thus bring about the relief of symptoms, clearing of the roentgenographic shadow

and a change in bronchoscopic findings, although there has been no change in the carcinoma. The first symptoms of cancer of the lung may result from distant metastases and not from the local lesion.

In a patient who previously has been well, carcinoma of the lung must be suspected if he develops a persistent pulmonary symptom of any kind, especially chest pain. Pain in the chest, cough, and expectoration of blood comprise the typical triad of symptoms. The physician always should be cautious of the so-called cigarette cough, the cold that hangs on, the virus pneumonia, and the unresolved pneumonia. All of these may be masking an underlying and unsuspected cancer of the lung.

Hemoptysis is a frequent symptom of cancer of the lung. Whenever such a symptom can be elicited the physician should search thoroughly for the cause of the bleeding. This symptom was reported in 42.3 per cent of the patients in this series. It is alarming to learn that the time interval from the first hemoptysis to consultation with the thoracic surgeon averaged 9.7 months in the group found inoperable without exploration; in the group operated upon the time interval was 5.9 months for those not resected and 5.3 months for those who were resected. Education of the public concerning this easily recognizable symptom alone would permit the patient to seek medical attention at a much earlier date.

Pain in the chest is a frequent symptom in lung cancer. When this symptom is reported it should place the doctor on guard for carcinoma of the lung. It may result from pleurisy and then is less important, since many other diseases may cause the same type of pain. Often it is a steady pain not related to pleurisy and as such the pain referred to the chest wall is caused by tumor invasion of the bronchial wall. The tumor need not necessarily be in contact with the chest wall to produce pain. In other instances the chest pain may result from local invasion of the chest wall by tumor. This type of pain was a symptom in 50.1 per cent of the patients in this series. On occasion pain may be referred over the vagus nerve and occur in the ear, the jaw or in the abdomen. In this series 6.3 per cent of the patients had abdominal pain as their only initial complaint. Three patients complained of pain in the jaw which caused them to seek medical treatment and led to the diagnosis of lung cancer.

Cough is an important symptom of carcinoma of the lung but it also is caused by many other conditions. It was noted in 65.2 per cent of the patients in this series. Occasionally it is possible to find a peripheral, parenchymal lung cancer with a total absence of cough.

Weight loss is an ominous sign unless it is caused by some complication of the neoplasm, such as infection with fever. These patients gain weight when the complication is overcome. One patient gained 22 pounds in 12 months while under treatment for pulmonary tuberculosis. This was a mistaken diagnosis as later proved by pneumonectomy. He has remained alive and well and has now survived 9 years after the operation. However, if malaise and weight loss are caused by metastasis of the tumor no improvement can be expected. Such a condition is encountered in patients who have developed malaise and weight loss without other symptoms.

Dyspnea rarely is the result of involvement of a large parenchymal area of

lung or of vascular obstruction by the tumor. It frequently is caused by atelectasis or by reflex bronchial spasm. Lung cancer may be superimposed on a lung already damaged by emphysema or some other pulmonary conditions.

The physical findings in carcinoma of the lung can be as variable as the symptoms. The absence of physical findings is more characteristic than their presence; however, wheezing, especially unilateral or unilobar, is reasonably suggestive. In several patients a situation has been encountered where there is a normal percussion note and an absence of breath sounds over a lobe or a whole lung, but with a chest roentgenogram that shows the lung or lobe to be well aerated. In each instance this has been found to result from bronchial obstruction caused by a tumor which would allow air to enter the parenchyma but would not allow air to escape. The lung or lobe was kept inflated but there was no ventilation or exchange of air and consequently no breath sounds. It is suspected that atelectasis would have resulted if enough time had elapsed to permit the tumor to completely block the involved bronchus.

If the public could be made more aware of the importance of pulmonary symptoms perhaps the patient with such symptoms would seek medical attention sooner. In the present series the time lapse from the onset of symptoms to a diagnosis of cancer of the lung in those found inoperable without exploration was as follows: In 75 patients—1 to 6 months, in 31 patients—7 to 12 months, and in 29 patients—over 12 months. In 5 patients the time interval could not be determined. In 16 patients who refused surgery the time interval from the onset of symptoms to diagnosis was: In 8 patients—1 to 6 months, in 3 patients —7 to 12 months and in 5 patients—over 12 months. The time interval from the onset of symptoms to the diagnosis in those patients found resectable was: In 88 patients—1 to 6 months, in 17 patients—7 to 12 months, and in 8 patients—over 12 months. In 13 patients the time interval could not be determined. It is difficult to determine the exact time in months, but it is obvious that there is a great difference in the time element from the first symptom to the time of diagnosis.

The diagnosis of cancer of the lung depends upon a high degree of suspicion of the disease by the physician whenever he sees a patient 30 years of age or older who has a chronic pulmonary condition. A roentgenogram of the chest is the best single diagnostic procedure, with the history, bronchoscopy, and the physical examination following in decreasing importance.

The preoperative diagnosis can be absolute when carcinomatous tissue is obtained for tissue study or it may depend upon a fairly strong clinical impression which can be surprisingly accurate when all other conditions have been eliminated. The clinical diagnosis is confirmed or refuted by exploratory thoracotomy. Theoretically, diagnosis by cytologic study of the sputum and bronchial secretions should be one of the best means of arriving at a diagnosis and is so reported by many workers; however, it has been of little help in this series.

The tissue diagnosis can be made by bronchoscopic biopsy, by biopsy of the lymph nodes and other distant metastases, by groups of malignant cells in the pleural fluid, and by needle biopsy of the original tumor. In at least 3 patients of this group a diagnosis was made by a pathologic study of tissue coughed up

by the patient and brought to the family physician, who sent it to the pathologist for study.

Bronchoscopic biopsy was positive in 30 or 15.8 per cent of the patients who were subjected to exploratory thoracotomy. It is interesting to note that in those explored but who could not be resected, 18 of 63, or 28 per cent, positive bronchoscopic biopsies were reported; however, in those explored who had the lung extirpated only 12 of 126, or 9.5 per cent, had a positive bronchoscopic biopsy. Those patients found inoperable by biopsy of distant metastasis rarely were bronchoscoped. It seems certain the yield of positive bronchoscopic biopsy in these would be greater. Obviously the earlier the disease is detected the less likely will be the positive diagnosis by tissue biopsy. Thus it is indicated that diagnosis should be made early enough in the disease to eliminate tissue diagnosis, unless the growth occurs in a large bronchus. Under such conditions a clinical diagnosis must be relied upon to warrant thoracic exploration.

An enlarged lymph node found anywhere should be removed for study. Normal inguinal and axillary lymph nodes in the adult can be palpated routinely. However, normal lymph nodes in the cervical region cannot be palpated. In this series, if any examiner, house officer or other worker believed a cervical node to be palpable, the cervical region was explored. However, in this series exploration of the lower neck and superior mediastinum were not a routine procedure.

Malignant pleural fluid was found in 25 of the patients in this series. This diagnosis is not a cytologic diagnosis since groups of cells often are found. These patients were considered inoperable without exploration. Needle biopsy of the original tumor was reserved for those who, because of associated disease or because of age and debility, were considered inoperable. There is fear of spreading the tumor through the chest wall or into adjacent tissue and accordingly needle biopsy is contraindicated if the patient has an operable tumor.

Since 1948 cytologic studies of bronchial secretions have been made on all patients in this series who did not have a diagnosis made by biopsy of distant or lymph node metastasis. The work has been interesting, but has been of no real importance in this series. The degree of clinical suspicion exercised has been of greater value than the cell study. There have been a few false positive and many false negative cell studies. None has led to neglect of the patient or to unnecessary surgery.

The clinical diagnosis is based upon the ruling out of tuberculosis through appropriate studies and by eliminating other pulmonary disease as far as possible. Great reliance is placed upon roentgenographic findings, history, and the bronchoscopic findings. When a bronchoscopic biopsy is not obtained the clinical impression or diagnosis can be made by bronchoscopic study. It is a valuable aspect of the over-all clinical diagnosis of carcinoma of the lung and when such a diagnosis is made it is more important than the roentgenographic study. The history, as previously stated, shares an important part in the clinical diagnosis. Nevertheless, roentgenographic study is the most valuable single procedure in the diagnosis of cancer of the lung.

Although the roentgen ray examination is so valuable in the clinical diagno-

sis there are no infallible diagnostic characteristics. The single round mass is highly characteristic, but in the young it often is a tuberculoma and in older people it may be a rare benign tumor. It may be a filled cyst or even a metastatic tumor. The unexplained atelectasis of a segment, lobe or lung is highly characteristic of cancer. The finding of a cavity is suspicious but more often may be a pyogenic abscess, tuberculosis or a cyst. Localized emphysema, especially if later followed by atelectasis, is characteristic. The hilar density frequently is an important finding since other causes of lymph node enlargment are not as dense as those caused by tumor. The presence of fluid must be looked upon with suspicion, particularly when the mediastinum is in the midline or shifted to the side of the fluid. Laminographic study often gives valuable information. Bronchographic examination may prove helpful. An apparently occluded bronchus may in reality not be blocked, the lack of filling being the result of mechanical failures during the procedure. The presence of bronchiectasis or a normal tracheobronchial tree does not rule out carcinoma of the lung. The mass roentgenographic surveys and the routine chest roentgenograms upon hospital admission are invaluable diagnostic aids. Every patient who suffers trauma to the chest should have a roentgenogram of the chest. This is especially important if hemoptysis follows the chest injury. In a number of patients in this series the hemoptysis after chest trauma resulted from a carcinoma and not from the trauma. Only 9 of these patients were found to have cancer of the lung when a routine roentgenogram of the chest was made, even though the patient was well and symptom free. Exploratory thoracotomies were done in all of these, and in 8 the disease and the lung were removed. Only 1 of the 9 was found unresectable. This should be compared with the whole series in which 33 per cent of those explored could not be resected.

In the roentgenographic examination of the chest a lateral view is of utmost importance and always should be taken. The position of the patient is important since rotation of the patient (fig. 2) may cause the lesion to be overlooked or it may cause a lesion to appear smaller on observation. Routine fluoroscopic examination of the chest is an important diagnostic procedure.

The clinical diagnosis should be confirmed or refuted by thoracic exploration; obviously a chest lesion that is undiagnosed by a roentgenogram should have the benefit of thoracic exploration. When this exploration is undertaken there should be available a competent pathologist to make frozen section examinations of removed tissue. The tissue may be taken from a lymph gland, the parietal or mediastinal pleura, or it may be the whole lesion removed by wedge resection, segmental resection or by lobectomy. Care should be exercised not to cut into the lesion and spill malignant cells or tissue into the pleural cavity. In many patients a biopsy cannot be obtained without contamination of the pleural cavity by malignant cells or infection. In such instances the lung must be removed, based upon the clinical diagnosis with palpation of the diseased organ as an additional aid. It is distressing to the surgeon to realize that a carcinoma may be present and escape detection by palpation. In 1 patient roentgenographic study showed that the lesion and the symptoms had disap-

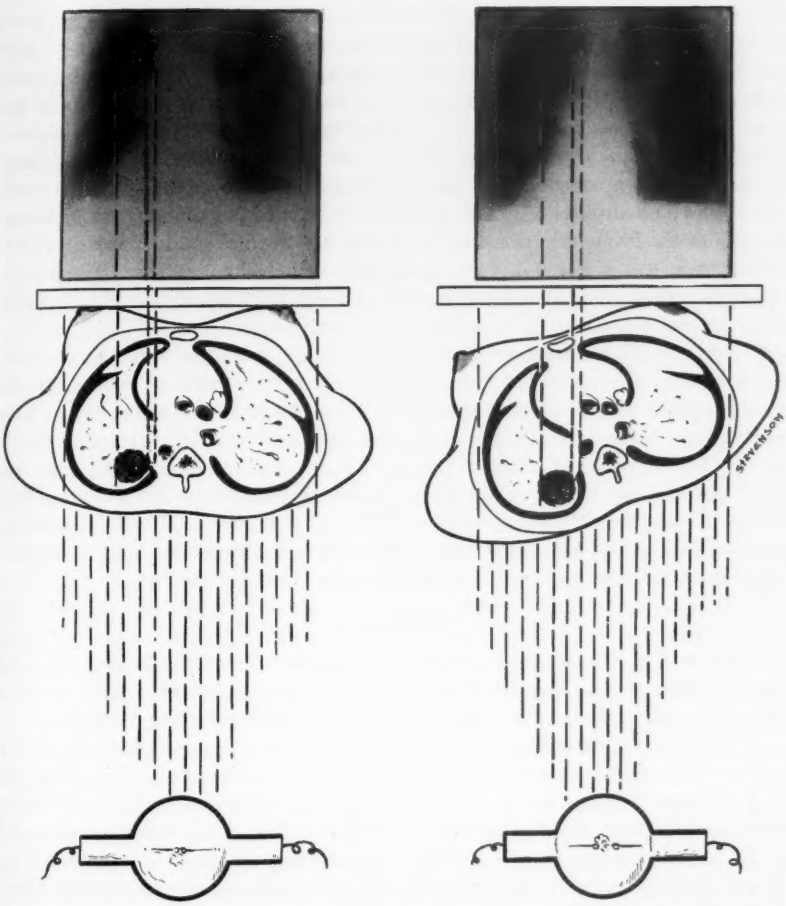

FIG. 2. This drawing and roentgenographic combination was prepared in order to show how rotation of the patient might easily give the illusion that the lesion had cleared or become smaller. If the lesion is posteriorly or anteriorly located near the medial aspect of the lung and in the lower portion of the chest, rotation of the chest in one direction will make the lesion stand out prominently; whereas, rotation in another direction will cause it to disappear behind the heart shadow. The roentgenogram shows a carcinoma of the lung located in the posterior aspect of the chest. Film (B) was taken one month after film (A). It was interpreted as showing marked improvement because rotation of the chest was not considered. At exploratory thoracotomy a squamous cell carcinoma of the superior dorsal segment of the lower lobe of the right lung was found.

peared. However, bronchoscopic examination showed a small growth in the right upper lobe bronchus at the segmental orifices, beyond reach of the biopsy forceps. Cell study proved negative. Upon thoracic exploration nothing abnormal could be detected. After surgical dissection the upper lobe bronchus was

bare yet the tumor could not be detected; however, when the lobe was removed there was found an early bronchogenic carcinoma of the squamous cell type involving a segmental bronchial orifice. In another instance serial roentgenograms of the chest showed that the lesion had disappeared. Cell study of the bronchial secretions was positive. Bronchography showed a small area of bronchiectasis in the anterior segment of the upper lobe of the left lung. Upon thoracic exploration nothing abnormal could be found by palpation or inspection. The anterior segment of the upper lobe of the left lung was removed because of the bronchiectasis. In view of the positive cell study a frozen section examination was made and it showed a squamous cell carcinoma. Thoracic exploration alone would not have revealed either of these lesions. The thorough study before operation led to the finding of the lesion.

The course of carcinoma of the lung is unpredictable. Early diagnosis should be the goal. Under any circumstances, the sooner treatment is carried out the greater should be the longevity; however, the resistance of the patient is more important to longevity than is early diagnosis and treatment. Overholt[22] presented chest films which showed a mass over a period of 9 years. The mass was found to be a carcinoma of the lung and resectable. When the course of lung cancer is considered, spontaneous remission as reported by Blades[3] should be mentioned. Host resistance to the carcinoma is perhaps the most important single factor in the longevity of a patient with cancer of the lung.

TREATMENT

When a diagnosis has been made some method of treatment should be offered to the patient. Roentgen ray therapy probably has never been given an adequate trial. There is no method of determining whether metastasis has occurred without exploring the chest. This is extremely important when it is realized that in the present series only 36 per cent of the entire group had the lung resected and not all of them were free of mediastinal metastases. If the chest is explored a resectable lesion is removed. Therefore, radiation therapy is never given a trial in known localized carcinoma of the lung. Even though the results of surgery for lung cancer are not satisfactory there is nothing better to offer the patient at this time. The indications for surgery are either a clinical or tissue diagnosis of carcinoma of the lung and a patient whose condition is strong enough to tolerate operation.

It is an obligation of the thoracic surgeon to save the patient from a useless operation and to search carefully for signs that would contraindicate operation. These signs are: Invasion of the vertebrae by the growth, Pancoast syndrome, Horner's syndrome, pleural fluid showing malignant cells, distant metastasis, especially lymph node involvement, metastasis to the opposite lung, cardiac disease, and emphysema, or other medical conditions of such severe degree that the patient would have no chance to survive operation. There are borderline contraindications for surgery such as chest wall invasion, phrenic paralysis, vocal cord paralysis, pleural fluid that is not positive for malignant cells, huge size of the tumor, and age of the patient. These should be defined

more specifically, but only on rare occasions is it possible for patients with these findings to have the cancer extirpated. In this series the latter have not been considered definite contraindications to surgery, yet of the entire group 40.5 per cent of the patients were considered inoperable without thoracic exploration.

When the chest is open there are signs of nonresectability or contraindications to resection. These are findings that could not be determined before operation, such as extensive mediastinal lymph node metastasis, metastasis to the pleura and heart muscle, invasion of the aorta, and a neoplasm so invasive of surrounding structures that a clean or complete resection is impossible. In this series 189 patients, or 54.7 per cent, were subjected to thoracic exploration and 63 patients, or 33 per cent of those explored, were found to be inoperable after the chest was opened. These were not resected because of extensive mediastinal invasion in 46, invasion of the great vessels in 5, and invasion of the heart, diaphragm and pleura in 12. It is difficult to accomplish a palliative resection unless the patient is suffering from definite pulmonary symptoms that can be relieved by the resection. Relief will not be afforded by removing a lobe or lung in the face of widespread mediastinal metastases when the patient is free of pulmonary symptoms.

Each surgeon perhaps has his own philosophy and some are more optimistic than others. The authors are of the opinion that once the chest is opened the lung should be removed if possible so long as there is no metastasis. Local invasion is not a contraindication if the entire tumor can be removed cleanly. This belief has led to a high operative mortality rate, since a part of the left auricle and/or pericardium was removed in 28, or 22 per cent, of the patients. Local excision of the superior vena cava was done only once; block dissection of the chest wall and en masse removal with the lung was done in 11 instances. In 1 patient the lower end of the trachea and opposite main bronchus was resected. This 51 year old physician died of a massive myocardial infarct and not from the tracheal and bronchial repair. Portions of the diaphragm frequently have been resected with the growth.

Whether a lobe or the whole lung should be resected depends upon the philosophy of the individual surgeon with regard to cancer. However, when one realizes that 40.5 per cent of the patients are not given the opportunity of exploration and 33 per cent of those explored cannot have the lung resected, it becomes evident that in only a few is it technically possible to do a lobectomy. Therefore, the question is of academic interest rather than of practical importance. In this series lobectomy was done in only 6 patients and then only when there was reason to believe the cardiac or respiratory function would not permit pneumonectomy. Two of these 6 died in the hospital after operation. Of the 4 who survived operation 1 lived 3 years and died of a coronary occlusion according to autopsy. If earlier lesions were found by routine chest roentgenograms it would become more important to contrast longevity in lobectomy patients against those with pneumonectomy for treatment of cancer of the lung. The lymphatic drainage of the lung is such that the lymph glands are charac-

teristically located at the bifurcation or branching of the tracheobronchial system; consequently lobectomy does not permit a good lymphatic resection.

In this series the technic of pneumonectomy has for many years included a complete dissection of the mediastinal glands. The bronchus always has been closed with interrupted silk sutures and the closed bronchial stump has, since the first resection in 1941, been covered by viable tissue. The worth of this procedure has been proved by Brewer.[9] Most patients have been operated upon in the lateral position since it apparently affords the best exposure and perhaps results in a higher percentage of resections of the lung. The pleural cavity is protected from infection by the use of a mixture of sodium tetradecyl sulfate, azochloramide, and sulfanilamide. The pleural cavity is closed without drainage.

When caution is used to adequately close the bronchial stump and cover it with living tissue, when contamination of the pleural space is avoided and careful attention is given to the control of shock, there are few major complications. A bronchopleural fistula developed in only 2 patients and empyema without a bronchopleural fistula was found in 2 other patients in this series.[8]

RESULTS

The hospital mortality here after resection of the lung cancer was 31, or 24.6 per cent, in the 126 patients who had the lung resected. The rate is rather high and compares with the hospital mortality rate of 22 per cent reported by Gibbon,[14] 20 per cent by Ochsner,[21] 23 per cent by Husfedt,[17] 33 per cent by Bartel,[2] and 7.7 per cent recorded by Watson.[23] The high hospital mortality rate in those who had complete removal of the cancer can be attributed to the theory that an invasive carcinoma without metastasis should be extirpated if it is surgically possible. It also is believed that patients should not be refused operation for lung cancer unless there is definite evidence that they cannot tolerate the operative procedure. Obviously, by more careful screening, the elimination of poor surgical risks, and by a more conservative operative technic the mortality rate could be reduced considerably. Such a course undoubtedly would deny to many patients the benefit of having their lung cancer extirpated. Death from shock, hemorrhage and infectious complications is preventable and greater caution in the treatment and prevention of these conditions will reduce the operative mortality rate. In a survey of the 31 patients who died following extirpation of the disease there were 18 cardiac deaths, 11 from cardiac insufficiency and 7 from coronary occlusion. It would appear that more careful screening might prevent a few deaths among those with cardiac insufficiency, but if they are denied surgery they will die from their lung cancer. In many of these patients preoperative study did not show a questionable cardiac status. It is difficult to estimate how many borderline cardiac patients successfully had extirpation of the disease. Among those who died from coronary occlusion there appeared to be no method of prevention, since in the majority there was no indication of coronary artery insufficiency before or during the operative procedure. It is interesting to point out that Hammond[15] believed that cigarette

smoking not only increases the death rate from cancer of the lung but also almost doubles the expected death rate from coronary artery disease. One may well ask whether this is not a double-edged sword and whether it does not account for the high death rate from coronary artery disease after extirpation of the lung for cancer. There is reason to believe that age is an important factor in the mortality rate in surgery for lung cancer. The average age of those who died from cardiac causes in this series was 57 years, with a spread of years from 41 to 67. The average age of those dying postoperatively from other causes was 59 years, with a spread of years from 42 to 74.

It is probable that when lobectomy can be done instead of pneumonectomy the postoperative mortality rate may be lowered; however, in this series only 6 lobectomies were done for lung cancer and 2 of these patients died, 1 from cardiac insufficiency and the other from coronary artery occlusion. It is true that in all 6 instances the patients were considered such poor surgical risks that the lesser operation was done.

The follow-up has been complete. The 5 year survival rate for those who survived extirpation of the lung cancer is 26.6 per cent. The figures are the same as those generally reported by other workers in this field. It is difficult to determine preoperatively as well as at operation which will have a long time survival. It is obvious that no patient with mediastinal lymph gland metastasis has survived operation 5 years or longer. The patient who is the longest survivor, 14 years, had a metastatic tumor in the large hilar glands but none in the mediastinal glands.

CONCLUSIONS

There appears to be a definite increase in the incidence of carcinoma of the lung. Since our population is aging and increasing there will be at least a two-fold increase in the incidence of lung cancer in the next 20 years unless other factors can be developed to counteract this tendency.

Awareness of the medical profession and the public to lung cancer will result in earlier diagnosis and thus lessen the mortality rate. It also will increase the operability rate and improve the longevity of patients with carcinoma of the lung.

All patients over the age of 30 who develop a persistent or chronic pulmonary symptom, especially chest pain, should be carefully studied in order to rule out lung cancer. Thorough consideration of the patient's history will help materially in an early diagnosis.

A routine roentgenogram of the chest in all hospital admissions will help greatly in making an early diagnosis.

Cardiac insufficiency or occlusive coronary artery disease is the most common cause of postoperative death.

In lung cancer one may expect 40 per cent to be inoperable when first seen. Of the 60 per cent who are given the benefit of exploratory thoracotomy about 35 per cent will be nonresectable; of the 65 per cent who have the lung cancer

extirpated a hospital mortality rate of 20 to 25 per cent can be expected. In those who survive extirpation of the carcinoma 25 per cent will survive five years or longer.

REFERENCES

1. Adler, I.: Primary Malignant Growths of the Lungs and Bronchi, New York, Longmans, Green and Company, 1912.
2. Barthel, H.: Results of lung resections in bronchial carcinoma, Thoraxchirurgie *1:* 337 (Nov.) 1953.
3. Blades, B., and McCorkle, R. G., Jr.: Case of spontaneous regression of untreated bronchiogenic carcinoma, J. Thoracic Surg. *27:* 415 (April) 1954.
4. Brantigan, O. C.: Carcinoma of lung, Bull. School Med. Univ. Maryland *32:* 131 (Jan.) 1948.
5. Brantigan, O. C.: Carcinoma of lung, Southwestern Med. *32:* 12, 1951.
6. Brantigan, O. C., and Hadidian, C. Y.: Cancer of lung, accepted for publication in Md. State M. J., 1954.
7. Brantigan, O. C., and Hadidian, C. Y.: Complications following pulmonary surgery, Am. J. Surg. *89:* 70 (Jan.) 1955.
8. Brantigan, O. C., and Haynes, J. D.: Surgery of stomach and duodenum in aged, accepted for publication in Am. J. Gastroenterology, 1954.
9. Brewer, L. A., Lilly, L. J., King, E. L., and Bai, A. F.: Bronchial closure in pulmonary resection; clinical and experimental study using pedicled pericardial fat graft reinforcement, J. Thoracic Surg. *26:* 507 (Nov.) 1953.
10. Clark, R. L., Jr., and White, E. C.: Biologic and clinical aspects of malignant melanoma with outline of treatment, Tr. South. S. A. *63:* 233, 1951.
11. Doll, R., and Hill, A. B.: Study of aetiology of carcinoma of lung, Brit. M. J. *2:* 1271 (Dec. 13) 1952.
12. Engleman, R. M., and McNamara, W. L.: Bronchiogenic carcinoma; statistical review of 234 autopsies, J. Thoracic Surg. *27:* 227 (March) 1954.
13. Frazier, T. M.: Director, Bureau of Biostatistics, Baltimore City Health Dept., personal communication, (Feb.) 1955.
14. Gibbon, J. H., Jr., Allbritten, F. F., Jr., Templeton, J. Y., III, and Nealon, T. F., Jr.: Cancer of lung; analysis of 532 consecutive cases, Ann. Surg. *138:* 489 (Oct.) 1953.
15. Hammond, E. C., and Horn, D.: Relationship between human smoking habits and death rates, J. A. M. A. *155:* 1316 (Aug. 7) 1954.
16. Hueper, W. C.: Environmental lung cancer, Indust. Med. *20:* 49 (Feb.) 1951.
17. Husfeldt, E.: Carcinoma of lung, Indian J. Surg. *15:* 135, 1953.
18. Machle, W., and Gregorius, F.: Cancer of respiratory system in United States chromate-producing industry, Pub. Health Rep. *63:* 1114 (Aug. 27) 1948.
19. McGrath, E. J., Gall, E. A., and Kessler, D. P.: Bronchiogenic carcinoma, product of multiple sites of origin, J. Thoracic Surg. *24:* 271 (Sept.) 1952.
20. Miller, W. S.: The Lung, Springfield, Ill., Charles C Thomas, 1947.
21. Ochsner, A., DeCamp, P. T., and Ray, C. J.: Bronchogenic carcinoma with emphasis on early diagnosis, Geriatrics *9:* 15 (Jan.) 1954.
22. Overholt, R. H., and Schmidt, I. C.: Silent phase of lung cancer, J. A. M. A. *141:* 817 (Nov. 19) 1949.
23. Watson, W. L.: Radical surgery for lung cancer, S. Clin. North America *33:* 401 (April) 1953.
24. Wynder, E. L., Graham, E. A., and Croninger, A. B.: Experimental production of carcinoma with cigarette tar, Cancer Res. *13:* 855 (Nov.) 1953.

TREATMENT OF CANCER OF THE BREAST SHOWING TWENTY-FIVE YEARS OF PROGRESS

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A review of diagnosis and management of mammary cancer during the past 25 years demonstrates achievement in certain spheres; lack of progress in others. One cannot assume the responsibility of such a review and evaluation without being impressed by numerous contributions, both technical and philosophic, which have been published in the world literature since 1930. Likewise a certain pride must be felt by all of us in realizing that in the study of breast carcinoma during this time we are contemporaries of Harrington,[16] Adair,[1] Haagensen[12, 13] and others whose clinical experiences have so enriched our knowledge of the disease. As in the past, clinical physicians will continue to look to the research laboratory and the medical schools where basic research is being done, recognizing that the two basic questions, what is the cause, and what is the cure, remain unanswered. It is only at this basic level that a sense of futility is perceptible. In nearly all other variants of the problem real progress has been made.

The purpose of this contribution is (1) to review the published record of carcinoma of the breast since 1930 and (2) to present the personal experiences related to over 350 cancers of the breast.

ETIOLOGY

The etiology of mammary cancer remains unknown.[23, 25, 29] Many factors have been thought, in the past, to contribute to the onset of the disease. Notably among these were singleness, infertility, failure to nurse their babies, trauma, infection and abscess, late menopause and the use of hormones. Unfortunately, most of these have been impressions rather than facts. In the group of patients whose cases are reported here, only 21 per cent of the patients with the disease were single; 176 or 51 per cent of the patients had one or more successful pregnancies, and of these 114 had nursed their babies for six weeks or longer. This does not infer that the conclusions by others relative to these factors have been wrong; it only reveals that statistically these factors have little if anything to do with the etiology. Similarly, although it has been suggested by some that extracorporeal estrogen therapy may cause cancer of the breast, as well as in other organs, there is no single recorded instance in the literature to substantiate this possibility in the human being.

More fascinating, and certainly more practical, is the possible transmission of the cancer factor[29] from the nursing mother to the suckling child, that is, if one can infer such a possibility from animal studies. However, this is yet to be proved. There is some substantiation of the effect of menopause on incidence,

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since in this group 143 patients (43 per cent) were premenopausal and 197 (57 per cent) were postmenopausal. However, when one considers the occurrence of the disease in young women 10,[32] 16, 19 and 21 years of age,[8] the hormonal factor is obscured in mystery. The presence of other disease, such as chronic cystic mastitis in the breast, cannot be impugned as a cause of cancer because of the low incidence of the latter when compared to the relative frequency of cystic disease and mammary dysplasia.[10, 35]

PATHOLOGY

The principal achievements regarding pathology of cancer of the breast during the past two and one-half decades are threefold. First has been the general tendency of cooperation between pathologists and surgeons to reach a common ground of classification so that the language became universal. Second, the premalignant nature of the intraductal papilloma is documented by the appearance of papillary carcinoma as a definite type of the disease.[10, 11, 17, 21] Third, Paget's disease of the nipple now is recognized as an overt reaction to a deeper seated carcinoma of the breast, rather than a local lesion.[6, 9, 36] The classification used in this report is based upon that of Foote and Stewart and the results are given in table I.

DIAGNOSIS

It is an accepted fact that if all cancers could be detected at the early local stage and proper treatment applied, all should be cured. It is likewise a fact that ignorance, neglect, reluctance and resistance of the patient, and neglect or ignorance of the doctor are factors frequently delaying accurate diagnosis and treatment of the breast cancer. It is of considerable interest, therefore, that whereas Wevill[37] reported a delay of 14 months between onset of symptoms and treatment in 1932, that this study discloses a delay averaging only 8.2 months ranging from a few days to 8 years. In the last 100 consecutive cases seen, 54 of the patients had noted the lesion 1 month or less before examination. There can be little doubt that the educational program of the American Cancer Society, reinforced by the cooperation of the medical profession, has brought about this change.

The clinical features of advanced carcinoma of the breast are well recognized. However, the physician should remember that the earliest signs of cancer are, a (1) painless mass in the breast, (2) thickening of the breast, (3) nipple discharge,

TABLE I

Males	2	Carcinoma	349
Females	350	Sarcoma	3
Infiltrating duct cell	330		
Comedocarcinoma	9		
Papillary	7		
Medullary	2		
Apocrine gland	1		

(4) stabbing pain in the breast, and (5) an opaque shadow in the breast demonstrated by transillumination. More important, however, is the dictum: *Any lesion in the breast is malignant until proved otherwise!* At all times the final diagnosis should rest on the microscopic assay of the mass. It is in micropathologic technic that truly great progress has been made.

Frozen section diagnosis of operative biopsies and specimens was suggested and used before 1930, having been emphasized by Bloodgood[4] in 1929. However, its usefulness has been proved in the past 25 years so that today there can be little excuse for a radical operation without micropathologic proof of cancer whether it be of the breast or any other organ of the body. The continued practice of removal of lumps from patients while they are in the doctor's office under local anesthesia for later pathologic study is mentioned only to condemn it as emphatically as possible. The woman whose breast requires surgical exploration should be hospitalized so that the mass may be removed under conditions which allow for immediate radical mastectomy if the frozen section reports a cancer.[24] In our series none of 4 patients referred, who had office excisions elsewhere, survived five years.

The greater use of the aspiration and needle biopsy was promulgated by Hayes Martin[26] in 1930. The chief value of this procedure is in securing pathologic confirmation of the diagnosis in patients having inoperable carcinoma and those who refuse formal operative biopsy. This technic is used constantly in securing information on the breast mass, axillary, inguinal and cervical lymph nodes and thyroid gland. It is essential that a well trained and interested pathologist be available to complete the diagnostic team. Certain operative procedures of great magnitude may be avoided and made unnecessary by the judicious use of this valuable adjunct. Likewise the proper planning of the procedure to be carried out may be determined by the additional information that is gained.

Tribute must be paid to Haagensen and Stout[13] for their attempt to define operability or inoperability from the standpoint of probable cure or five year survival. In 1943 they discussed the following criteria of inoperability for cure:

(1) Carcinoma developing during pregnancy or lactation.
(2) Extensive edema of the skin of the breast.
(3) The presence of satellite nodules of the skin over the breast.
(4) The presence of intercostal or parasternal nodules.
(5) Edema of the arm.
(6) Proved supraclavicular node metastasis.
(7) Inflammatory type carcinoma.
(8) Distant metastasis proved.
(9) Any combination of ulceration, fixation, matting of axillary nodes, edema of limited extent in the skin.

Of these, the only criterion which is challenged in this report is that concerning pregnancy.[22] In our 352 cases there were 8 women operated upon either during or immediately after pregnancy for tumors which developed during pregnancy. Four are dead, surviving from 1 to 4 years. Four are living 2, 4, 6 and 10 years postoperatively.

Further progress in diagnosis has concerned itself with the status of the lymph nodes of the internal mammary chain. Although Halsted reported resecting this chain in 1894, it has been through the efforts of Handley,[14, 15] Urban[34] and McDonald, Haagensen and Stout[27] that attention has been refocused on the importance of breast drainage from the inner half and nipple areas to this group of nodes. As yet, there is insufficient evidence relative to the value of routine biopsy of the nodes of the first four intercostal spaces. We may well have to wait for the golden anniversary of the Southeastern Surgical Congress for a decision on the question. Potentially such a study should result in either routine extension of the radical operation to include the internal mammary chain, if involved by disease, or ruling such patients incurable by operation.

The use of the nipple smear[17] when discharge is present is most important. A study of the cytology of desquamated cells on 3 occasions has led to the diagnosis of deep-seated nonpalpable small cancers which otherwise would have gone for some time before clinical examination could have detected them. A Class V report on the smear demands repetition and, if confirmed, surgical exploration for frozen section diagnosis. In our patients the lesions measured 5, 7 and 9 mm. in diameter. Two lay deep beneath the nipple and one in the upper outer quadrant of the breast.

MANAGEMENT

The treatment of cancer of the breast logically falls into four phases: prophylaxis, the operable tumor, the inoperable tumor and metastasis and recurrence. A notable change[11, 17, 21] in the philosophy of management of the bleeding nipple has been to avoid mastectomy (as previously done), but rather to explore the duct system; find the lesion; secure frozen section diagnosis and then make the final decision. While simple local excision of a papilloma is regarded as ample prophylaxis, simple mastectomy is insufficient for cancer and excessive for prevention. These papillomas are regarded as premalignant,[10, 21] to be treated much as polyps of the rectum and colon.

The treatment of the operable carcinoma of the breast now is widely accepted as being surgical with or without the addition of roentgen ray therapy.[1, 7, 12, 20, 28] There has been no improvement on the basic plan of operation as described by Halsted. Certain phases of the technic regarding the incision have been suggested by numerous authors but notably by Rodman, Orr and McFee. However, confusion as to the proper skin flaps still seems to prevail. It would seem that study of the lymphatic drainage and enveloping fascia of the breast should suggest the proper flap. In this series the practice has been to sacrifice a minimum of 5 cm. of skin in all directions from the area of the tumor; develop almost skin thin edges to the flaps for a few centimeters, then follow a line superficial to the capsule of the breast for the remainder of the flap. The remainder of the operation is classical and standard with emphasis and attention placed upon sharp dissection of the sheath of the axillary vein and artery which are rich in lymphatic vessels. Electrocoagulation is used for hemostasis throughout the procedure, and has been used by us since 1932. The skin closure

requires grafting in less than 5 per cent of the patients. The wound is washed carefully with large quantities of normal saline before closure, removing blood, clots, debris and probably cancer cells,[5] thus reducing the incidence of local recurrence. Following the suggestion of Sugarbaker in 1952 the dressing of these large wounds has been considerably modified. A perforated rubber catheter is introduced well into the axilla through a small stab wound and anchored by a suture. It then is attached to a water suction drainage system. No other drains are used. A light dressing is applied. In the past one and one-half years, using this method, all wounds have healed per primam. Previously, slough of varying degrees had been encountered in about 25 per cent of the patients, requiring long after-care. One notable addition to the standard operative management of these patients has been blood replacement. When the frozen section diagnosis is reported, the anesthesiologist starts a blood transfusion. An average of 750 cu. cm. of whole blood is required to replace the blood loss of radical mastectomy based on sponges used and hematocrit estimations.

At this time proper credit must be given to Urban[34] for his work on a possible reasonable extension to the classical Halsted procedure. In 1952 he reported the findings in a group of patients upon whom he had resected the internal mammary vessels and lymph nodes with the adjacent sternal margin, through the fourth costal cartilages and intercostal muscles, all in continuity with standard radical mastectomy. His indication for the procedure is carcinoma occurring in the medial half of the breast or beneath the nipple because the lymph drainage of these areas may be either to the internal mammary, subclavicular or axillary group of nodes. The finding of metastatic disease in a high percentage of these nodes, particularly the second intercostal group, confirms the rationale of the procedure. However, the inevitable question of involvement of deeper mediastinal and cervical nodes comes into focus. If this latter course happens, then the procedure will not be accepted. If it does not occur, the extension should become a routine step in radical mastectomy upon its indication. Only time and a study of results will give us the answer. Other extensions of mastectomy such as a cervical node dissection have been reintroduced but it would seem that review of the experience of Halsted and Willy Meyer in the past would be evidence enough to prove the futility of this procedure in the presence of proved node involvement by the malignant disease.

There have been no operative or hospital deaths in this series. Ambulation is started the day after operation. The patient is encouraged to use the arm from the day of operation, a considerable change from the chest spica, Balkan frame suspension or the Velpeau bandage of 25 years ago.

The care of the patient with inoperable breast carcinoma remains an enigma. Irradiation therapy is the treatment of choice now as it was in 1930. Certain progress has been made in palliation of these patients by using androgen[30] and estrogen. More recently, Bateman[2] has been using Thiotepa injected locally and parenterally with evidence of regression and temporary control of the lesion. Time and experience will be necessary to evaluate this group of compounds. However, they do cast a ray of hope on an otherwise hopeless situation.

The consideration of metastatic or recurrent disease leads to the same conclusion as with the inoperable breast lesion.[18] Roentgen ray therapy over painful metastatic foci, pathologic fractures and lung fields being consumed by cancer offers the most certain relief of symptoms. The use of testosterone in the premenopausal patient, and estrogen or androgen in the postmenopausal group promises some degree of temporary relief. Huggins[19] has contributed greatly to our knowledge by his advocacy of oophorectomy and adrenalectomy in this group of miserable women. He stated that about 30 per cent will be symptomatically and clinically improved. No cures or five year survivals are reported from this heroic measure. The method for selection of patients may depend upon the microscopic pattern of the cancer, but as yet no clear cut criteria are apparent.

Little if any progress in the control of the infrequent inflammatory carcinoma has been reported. The beneficial effect of estrogen has been suggested in addition to time honored roentgen ray therapy. Bateman with the authors is treating 2 patients at this time using Thiotepa as an adjunct to deep irradiation. Any modality which will modify a disease which may kill the patient in six weeks will be progress. In this series no case of inflammatory cancer has been converted to satisfy operability, and all have been dead within eight months from estimated date of onset.

RESULTS

The prognosis of cancer of the breast depends upon:[1, 3, 12, 16, 22]

1. The extent of involvement by the tumor at the time of operation.
2. The degree of malignancy (Broder).
3. The presence of pregnancy or lactation.
4. The age and constitution of the patient.

Some definite improvement in the prognosis has been made. In 1930, Schreiner[31] reported an absolute five year survival rate of 16 per cent. The survival rate for Stage I was 52 per cent, Stage II—21 per cent, and Stage III—0 per cent. In 1931, Crile,[7] reporting on 1,347 cases, recorded a 30 per cent survival for five years. At a Forum of the American College of Surgeons in 1933 it was reported that 65 per cent of the patients will survive five years or longer if the axillary nodes were not involved by the cancer. The results of our series indicates a continued over-all improvement as follows:

241 patients; absolute five year survival.....53 per cent
205 operable patients; five year survival.....63 per cent
94 patients with axillary nodes involved.....35 per cent
111 patients without axillary nodes involved.....86 per cent

A remarkable study by Harrington[16] in 1953 concerns 15, 20 and 25 year survivals after treatment. Four thousand six hundred and thirty-seven patients, of whom 98.4 per cent were traced, were reported thus: 25.1 per cent lived 15 years or longer, 17.6 per cent lived 20 years or longer, 4.7 per cent lived 25 years or longer.

If there was no evidence of axillary node involvement: 48.2 per cent lived

15 years or longer, 36.4 per cent lived 20 years or longer, 26.7 per cent lived 25 years or longer.

Considering the age of onset of the disease, one could not expect a much more favorable outlook for life.

Local recurrences were reported as 20 to 25 per cent in 1930. In our series the incidence is 20, or 5.6 per cent. The big arm from lymphedema has occurred in 27 of our patients, or 7.6 per cent.

SUMMARY

Progress in the diagnosis, management and improvement of prognosis are demonstrable in carcinoma of the breast during the past 25 years.

As to diagnosis—the educational program of the American Cancer Society for the medical profession as well as for the laity has brought many more patients into the operable group than were seen 25 years ago. The use of transillumination and the estrogen test to differentiate between chronic cystic mastopathy and cancer has saved many women from unnecessary surgery.

Unfortunately, radical surgery still must be used to control the disease, but refinements of technic have improved the morbidity rate.

The ever enlarging field of cancer research brings hope that the underlying cause of the disease may be found and the therapy of cancer modified and improved.

REFERENCES

1. Adair, F. E.: Surgical problems involved in breast cancer, Ann. Roy. Coll. Surgeons England *4:* 360 (June) 1949.
2. Bateman, J.: Personal communication.
3. Bell, H. G.: Cancer of breast, Ann. Surg. *130:* 310 (Sept.) 1949.
4. Bloodgood, J. C.: Chronic cystic mastitis of diffuse, non-encapsulated cystic adenomatous type, Ann. Surg. *90:* 886 (Nov.) 1929.
5. Brandes, W. W., White, W. C., and Sutton, J. B.: Accidental transplantation of cancer in operating room, with case report, Surg., Gynec. & Obst. *82:* 212 (Feb.) 1946.
6. Costello, C. J.: Breast cancer and "Padget's Disease" of breast, A. M. A. Arch. Surg. *51:* 262 (Dec.) 1945.
7. Crile, G. W.: Analysis of 1347 cases of malignant tumors with special reference to management and end-results, Journal Lancet, *51:* 99 (Feb. 1) 1931.
8. de Cholnoky, T.: Mammary cancer in youth, Surg., Gynec., & Obst. *77:* 55 (July) 1943.
9. Dockerty, M. B., and Harrington, S. W.: Preclinical Padget's disease of nipple, Surg., Gynec. & Obst. *93:* 317 (Sept.) 1951.
10. Foote, F. W., and Stewart, F. W.: Comparative studies of cancerous versus noncancerous breasts, Ann. Surg. *121:* 6 (Jan.) 197 (Feb.) 1945.
11. Gray, H. K., and Wood, G. A.: Significance of mammary discharge in cases of papilloma of breast; clinical and pathologic study, A. M. A. Arch. Surg. *42:* 203 (Feb.) 1941.
12. Haagensen, C. D., and Stout, A. P.: Carcinoma of breast; results of treatment, Ann. Surg. *116:* 801 (Dec.) 1942.
13. Haagensen, C. D., and Stout, A. P.: Carcinoma of breast; criteria of operability, Ann. Surg. *118:* 859 and 1032 (Nov.) 1943.
14. Handley, R. S., and Thackray, A. C.: Internal mammary lymph chain in carcinoma of breast; study of 50 cases, Lancet *2:* 276 (Aug. 13) 1949.
15. Handley, R. S., and Thackary, A. C.: Invasion of internal mammary lymph nodes in carcinoma of breast, Brit. M. J. *1:* 61 (Jan. 9) 1954.
16. Harrington, S. W.: Fifteenth-year to forty-year survival rates following radical mastectomy for cancer of breast, Ann. Surg. *137:* 843 (June) 1953.
17. Hinchey, P. R.: Nipple discharge; clinicopathologic study, Ann. Surg. *113:* 341 (March) 1941.
18. Horsley, J. S.: Bilateral oophorectomy with radical operation for cancer of breast, Surgery *15:* 590 (April) 1944.

19. Huggins, C., and Dao, T. L. Y.: Adrenalectomy and oophorectomy in treatment of advanced carcinoma of breast, J. A. M. A. *151:* 1388 (April 18) 1953.
20. Irvine, A. D.: Analysis of published statistics in connection with mammary cancer, Canad. M. A. J. *45:* 42 (July) 1941.
21. Kilgore, A. R., Fleming, R., and Ramos, M. M.: Incidence of cancer with nipple discharge and the risk of cancer in the presence of papillary disease of the breast, Surg., Gynec., & Obst. *96:* 649 (June) 1953.
22. Lee, B. J.: Significant problems for obstetrician in field of mammary surgery, Am. J. Obst. & Gynec. *20:* 705 (Dec.) 1930.
23. Lewison, E. F., and Allen, L. W.: Antecedent factors in cancer of breast, Ann. Surg. *138:* 39 (July) 1953.
24. Lockhart, C. E., and Ackerman, L. V.: Implications of local excision or simple mastectomy prior to radical mastectomy for carcinoma of breast, Surgery *26:* 577 (Oct.) 1949.
25. MacDonald, I.: Mammary carcinoma, Surg., Gynec. & Obst. *74:* 75 (Jan.) 1942.
26. Martin, H. E., and Ellis, E. B.: Biopsy of needle puncture and aspiration, Ann. Surg. *92:* 169 (Aug.) 1930.
27. McDonald, J. J., Haagensen, C. D., and Stout, A. P.: Metastasis from mammary carcinoma to the supraclavicular and internal mammary lymph nodes, Surgery *34:* 521 (Sept.) 1953.
28. McWhirter, R.: Treatment of cancer of breast by simple mastectomy and roentgenotherapy, A. M. A. Arch. Surg. *59:* 840 (Oct.) 1949.
29. Morse, D. P.: Hereditary aspect of breast cancer in mother and daughter, Cancer *4:* 745 (July) 1951.
30. Prudente, A.: Postoperative prophylaxis of recurrent mammary cancer with testosterone propionate, Surg., Gynec. & Obst. *80:* 575 (June) 1945.
31. Schreiner, B. F.: Results of treatment of cancer of breast; based on study of 489 cases, 1914–1925, Ann. Surg. *93:* 269 (Jan.) 1931.
32. Sears, J. B., and Schlesinger, M. J.: Carcinoma of the breast in a 10 year old girl, New England J. M. *223:* 760 (Nov. 7) 1940.
33. Tomlinson, W. L., and Eckert, C. T.: "Categorically inoperable" carcinoma of breast, Ann. Surg. *130:* 38 (July) 1949.
34. Urban, J.: Radical mastectomy in continuity with en bloc resection of internal mammary lymph-node chain, Cancer *5:* 992 (Sept.) 1952.
35. Warren, S.: Relation of "chronic mastitis" to carcinoma of breast, Surg., Gynec. & Obst. *71:* 257 (Sept.) 1940.
36. West, J. P., and Nickel, W. F., Jr.: Paget's disease of nipple, Ann. Surg. *116:* 19 (July) 1942.
37. Wevill, L. B.: Malignant disease of breast; statistical survey of 1,000 case records, Edinburgh M. J. *39:* 714 (Dec.) 1932.

TWENTY-FIVE YEARS OF PROGRESS IN THE TREATMENT OF ACUTE PERITONITIS*

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Much of the advancement in the therapy of acute peritonitis in the last 25 years involves improvement in the well established methods of treatment. It is true that many new methods have been added but in no sense do they abolish many of the older methods. As methods of treatment have advanced so have methods of prevention of acute peritonitis improved. It would be difficult, or perhaps impossible, to estimate the value of prevention in terms of mortality rate. Undoubtedly more accurate diagnosis, a more definite estimation of the patient's general condition, a knowledge of changes in metabolism due to disease, improvement in operative technic and anesthesia, proper timing of operative procedures, a better understanding of preoperative preparation and postoperative care of the patient, and a greater knowledge of infections in general have done much to reduce the incidence of acute peritonitis and to improve its treatment.

Of chief interest to the surgeon are those types of infection of the peritoneum arising by contamination from the gastrointestinal tract and those introduced at the time of operation.

For purposes of discussion the management of acute peritonitis may be divided into the following headings:

1. Early and more accurate diagnosis
2. Bacteriology of acute peritonitis
3. Operation and drainage
4. Decompression therapy
5. Restoration of metabolic balance by replacement therapy
6. Use of antibiotics
7. Use of narcotics
8. Oxygen therapy
9. Bed posture
10. Local application of heat
11. Use of enemas and colon tube
12. Use of drugs to stimulate peristalsis
13. Training of surgeons, anesthetists, and the public
14. Mortality rate
15. Conclusions.

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EARLY AND MORE ACCURATE DIAGNOSIS

When acute peritonitis is a possibility a constant awareness of this possibility is imperative. Infections of the peritoneum do not always present a typical appearance. Other diseases may simulate peritonitis. To establish a diagnosis of acute peritonitis (local or general) involves a careful study of the possibilities of an infection or other disease elsewhere in the body. Abdominal distention due to an accumulation of gas in the intestine does not always indicate that peritonitis exists. Ileus may result from disease outside of the abdomen or from such diseases within the abdomen as intestinal obstruction, volvulus, strangulation of the bowel, mesenteric thrombosis, and enteritis.

In 1930 Ochsner and Granger[42] described a method of roentgenographic diagnosis of obstruction of the bowel which has become standard. It now is used routinely in the diagnosis of all abdominal distentions. As soon as a patient enters the hospital with abdominal distention roentgenograms (scout films) of the abdomen, in both supine and erect positions, are made to demonstrate the location and degree of distention and fluid levels within the bowel. Such roentgenograms may not always enable the surgeon to make a diagnosis of peritonitis, but if peritonitis exists it will aid in estimating the extent of the infection and, if exudate is present, will suggest that ileus is due to peritonitis and not to intestinal obstruction. When the diagnosis of peritonitis is doubtful Moretz and Erickson[40] (1954) have advised that peritoneal tap be used both to establish the diagnosis of peritonitis and to identify the infecting organism. This method of diagnosis is not new and has not been very generally used. If the tap is properly made it has little danger and offers a fairly accurate means of proving or disproving the existence of peritonitis.

The standard methods of laboratory and physical examination need not be elaborated upon except to say that they should be made repeatedly, when necessary, to insure accuracy and detect changes which may develop rapidly. Careful taking, retaking, and verifying the patient's history may be of great value in making a diagnosis of peritonitis.

BACTERIOLOGY OF ACUTE PERITONITIS

Much has been added to our knowledge of the bacteriology of peritonitis in the past 25 years. The work of Altemeier[1] has been outstanding. In 1942 he studied 100 patients with peritonitis due to appendicitis with perforation of the appendix. In this series 16 species of aerobic and 18 species of anaerobic organisms were found. Occasionally as many as seven types of organisms were found in a single patient. There was much variation in virulence of the organisms. Altemeier found that foreign or dead material and strangulated omentum in the peritoneal cavity enhanced the virulence of the infecting organisms. The majority of bacteria would not produce peritonitis experimentally when injected in pure culture. When several strains were injected they did produce peritonitis. He concluded that multiple strains of bacteria have a synergistic effect and exist in a state of symbiosis.

It has been emphasized that the source of infection from the gastrointestinal

tract plays an important role in the mortality rate of peritonitis. For example, Mersheimer and Miller,[36] in a study of diffuse peritonitis secondary to intestinal perforation complicating malignant lesions of the colon, found that the mortality rate in their series was 81.25 per cent and in a collected series of 19 cases it was 78.9 per cent. This study presents a striking lesson that the mortality rate in peritonitis not only depends upon the virulence of the infecting organisms but also upon the type of pathology producing the infection.

It has been believed generally that cultures of exudate following perforations of peptic ulcer will be sterile in the early hours after perforation. Wright and associates[59] do not agree with this opinion. They found 90.91 per cent of positive cultures in 44 patients with perforated ulcers. They believe that a high percentage of cultures will be positive if properly made. If this conclusion is correct we cannot assume that merely a chemical peritonitis is produced by early perforation of a peptic ulcer. We can assume that the low mortality rate resulting from early operation for perforated peptic ulcer is, at least in part, due to the small number of organisms present.

The study of the sensitivity of individual organisms to the various antibiotics has done much to enhance the value of these therapeutic agents.

OPERATION AND DRAINAGE

Early operation and closure of a leak from the gastrointestinal tract has been and always will be rational treatment. If the opening has existed for more than 24 hours, and it is apparent that it is being sealed, or if it is a slow leak, operation may be postponed and in some instances may not be necessary. The plan, in recent years, of treating acute perforated peptic ulcers by nonsurgical methods is accepted by some surgeons but not by all. Improvements in technic of operations upon the gastrointestinal tract have reduced the incidence of peritoneal infection. These methods are all designed for the prevention of general peritonitis.

In well developed peritonitis operation is indicated in a large majority of the patients. In some cases a few hours may be well spent in preparing the patient for operation. The proper timing of operation and the care used to prevent soiling and spread of infection have improved the mortality rate. Operation may be contraindicated upon patients in extremis when death appears inevitable regardless of any type of treatment.

Drainage of abdominal infection has become more rational. Massive drainage and the use of gauze packs generally have been abandoned. The complications which may develop from drainage of the abdomen with tubes have been realized. Sump drains for accumulated exudates, and suction drainage applied in patients with a continuous flow of exudate or secretion from the abdominal viscera, are rational. In general, abdominal drainage is indicated for abscesses, accumulations of exudate, extensive soiling with stomach or intestinal contents, and accumulations of bile or foreign material.[19] In a recent discussion by Lazarus and associates[27] on modern concepts of intraperitoneal drainage they have stated that drainage for general peritonitis is contraindicated in the ab-

sence of foreign material or necrosis of the peritoneum. If the peritoneum is intact it need not be drained in anticipation of abscess formation.

The peritoneum can, in general, be depended upon to defend itself against infection. But doubt concerning drainage still exists in the minds of many surgeons and has led to the slogan '*when in doubt, drain.*' This slogan should be discarded and drainage should be used only when sound judgment dictates its need.

DECOMPRESSION THERAPY

In 1924 Matas[33] recommended gastric drainage with a Jutte tube and in 1925 Ward[57] described an apparatus for continuous gastric and duodenal lavage. It was not until 1932 when Wangensteen[58] reported his successful treatment of intestinal obstruction with nasal catheter suction-siphonage that the importance of this method of treatment was recognized generally. To Wangensteen is due the credit for making suction-siphonage a valuable method of treating the stomach and bowel when they are distended with gas and liquid. This treatment has been extended and applied in the prevention of all types of ileus.

Some of the defects in the decompression methods of treatment have been recognized and eliminated. Suction removes essential water and electrolytes which must be measured and replaced. The drinking of excessive quantities of water with a suction tube in operation increases the loss of electrolytes. Only sips of water should be permitted with suction-siphonage. Esophagitis and ulceration of the esophagus may develop if a tube remains in the esophagus for a long period of time. Otitis may develop when the tube is used in infants. The abdominal strain of removal and replacement of the tube may initiate wound disruption. The position of the tube in the stomach may minimize drainage. A knot has been known to develop in the tube, interfering with its function and making its removal difficult. Most important of all is the realization that the placing of an indwelling tube does not mean that it will function. Constant vigilance and adjustment of the tube and suction apparatus are necessary to produce good results. Suction tubes are not mechanical devices which will work alone. They need constant vigilance and plenty of it.

Such tubes as those designed by Miller and Abbott[37] and Cantor[8] have been used to decompress the small intestine. The limitations of these tubes have been recognized. They can be used with success when properly managed. They are often of least value when most needed because of the difficulty in introducing them into the intestine. While it is recognized that there is great value in the use of intestinal tubes for decompression, the statement of Paine[48] that he has not been convinced that the longer tubes are, with the increase in time, effort and bother to make them function, superior to the shorter Levin[28] tube with weighted tip, has much merit.

In the last 25 years it has been learned that the decompression tube is essential in the treatment of peritonitis. It prevents distention, relieves distention, reduces the incidence of vomiting, prevents bronchial aspiration, and, by relieving distention, promotes healing of abdominal wounds and prevents

wound disruption and evisceration. The value of the decompression tube in the prevention of distention is recognized. It has been estimated by Hibbard and Wangensteen[25] that 68 per cent of gas found in the gastrointestinal tract is swallowed air. The early use of the decompression tube is indicated when peritonitis is suspected or when there exists any factor which may produce abdominal distention by accumulation of liquid and gas in the stomach and small intestine. No patient, in this modern age, should die as a result of acute dilatation of the stomach.

The optimum time for removal of a gastric or intestinal suction tube sometimes is difficult to determine. Tube clamping and measurement of intake and output may be helpful. When the output is less than the intake the tube may be removed with reasonable assurance that gastrointestinal function is restored. When audible peristalsis is detected the suction tube no longer may be needed. It is probable that the indwelling nasal tube is introduced too often when not needed to prevent distention and left in place too long when it has been needed.

RESTORATION OF METABOLIC BALANCE BY REPLACEMENT THERAPY

A study of the changes in metabolism which occur in disease and their relationship to treatment has been epoch making. Much of this study has been made in the past 25 years. There is more to follow. Much still is to be learned. Some of the facts of today may become the doubts of tomorrow. To attempt more than a brief outline of what is known of metabolic changes and their influence upon modern therapy would be far beyond the scope of this discussion.

The first changes of significance in metabolism to be recognized were water and electrolyte imbalance. Imbalance of these vital elements leads to changes in acid-base balance and nutritional imbalance which may be lethal. It long has been known that the human body will tolerate starvation better than dehydration. To supply an adequate quantity of water is one of the first considerations in restoring and maintaining normal metabolism. But it soon was learned that the administration of too much essential water, under certain electrolyte imbalance, could be overdone, even to the point of water intoxication. Moore and associates[38] have said that overhydration is much commoner than dehydration in civilian surgery. They also have noted that gains in water and salt are frequent in starvation or after trauma. To maintain the delicate balance between water and electrolytes became the object of intensive investigation. It soon was apparent to clinicians that the knowledge of chemistry required in replacement therapy made its application far more intricate than other types of treatment.

When it was discovered that the administration of sodium chloride would prolong life in experimental animals[21] there developed a tendency to give too much sodium chloride in obstructive lesions of the gastrointestinal tract. General edema and pulmonary edema resulted. Coller and Maddock[11, 31] studied the water and sodium needs of surgical patients and warned against the use of excessive quantities of sodium in surgical patients, especially in the postoperative period. In the restoration and maintenance of metabolic balance the im-

portance of sodium, potassium[5, 6, 7] and, to a lesser extent, magnesium[23] soon became apparent.

The body changes incident to disease with weight loss must be corrected, particularly the blood volume. The effect of age upon metabolism must be considered in treatment. The sudden and continued impact of disease and trauma has been recognized by Selye[53, 54] who has described the *'alarm reaction'* and the *'adaptation syndrome.'* The role of the endocrine system has assumed major proportions in the cause and treatment of disease. The use of ACTH and cortisone in the treatment of surgical diseases is being investigated. Cole[10] has demonstrated the value of these endocrine products in the preparation of patients for operation.

To properly prepare the metabolism of the body for anesthesia and operation now is recognized as an important part of surgical treatment. Moore and associates have made outstanding contributions in their studies of metabolism related to trauma and disease. The work of Elman[16] has done much to emphasize the importance of food supply in preoperative preparation and convalescence of surgical patients.

The importance of losses from the body, both normal and abnormal, has been emphasized in surgical treatment. The normal losses of water and electrolytes in urine, in respiration, perspiration, and from the intestine, in addition to abnormal losses from vomiting, fistulas, drainage and diarrheas must be estimated and returned to the body as a part of replacement therapy.[26]

In replacement therapy one first must consider the normal requirements of the body. The minimum fluid intake should be about 2500 cc. daily. The daily need of sodium chloride can be supplied by giving 4.5 grams. Following operation it seldom is necessary to give sodium chloride for two or three days since trauma often causes a retention of sodium. The daily requirements of potassium in parenteral feeding usually is 20 to 40 mEq. One hundred grams of glucose usually are adequate. If there has been a reduction in blood volume transfusions are indicated.

If there has been any major depletion the deficiencies must be corrected before, during and following operation. The need must be estimated by estimating the loss. It is easy to overestimate this need. The required quantity of fluid usually can be given as 5 per cent glucose solution. Hypotonic sodium chloride solution, 4.5 per cent, usually will supply the daily requirements. In extreme cases of salt depletion 3 to 5 per cent sodium chloride solution may be used to avoid excess of fluid while restoring salt deficiency. One sixth molar (M/6) sodium lactate is useful in supplying sodium without chloride. Hartman's lactated Ringer's solution, Darrow's "K" lactate solution and Butler's multiple electrolyte solution are valuable in restoring and maintaining fluid and electrolyte balance. Ammonium chloride solution may be used for the treatment of alkalosis with hypochloremia. Twenty to 40 mEq. of potassium chloride may be added to the 5 per cent glucose solution to replace potassium deficit. Vitamins also should be added to the glucose solution. When parenteral feeding becomes a problem alcohol in 5 to 7 per cent may be added to the glucose solution. Commercial preparations of protein hydrolysate may be given.

All parenteral therapy must be based, not only upon the estimated losses, but upon the tolerance of the diseased tissues. There is nothing more complicated in the field of therapy than that concerned with restoration to normal of metabolic imbalance.

The monographs of Moyer,[41] Hardy,[24] Statland,[52] and Moore and Ball[39] summarize the learning related to body changes in disease in the last 25 years. The effects of general peritonitis often are so farreaching that nearly all of the problems of metabolism are of major importance in the treatment of this disease.

USE OF ANTIBIOTICS

The discovery by Domagk[14] in 1935 that prontosil was effective in the treatment of streptococcal infection in mice led to the development and use of the sulfonamides in the management and prevention of infections. Many sulfonamide compounds were made and used with some success. These drugs have been found inferior to more modern antibiotics.

In 1929 Fleming[18] discovered that a growth of penicillium retarded the growth of micrococcal cultures. He named the antibiotic produced *penicillin*. Ten years or more elapsed before penicillin and similar antibiotics were applied clinically to largely supplant the use of the sulfonamides.

Like many innovations in therapy the antibiotics have been used injudiciously and in excess. It now is known that antibiotics may mask infection.[13] Toxic reactions may develop from overuse and an occasional patient may have a sensitivity to antibiotics. Linder[29] was able to collect reports of 53 anaphylactic deaths of patients allergic to penicillin or penicillin combined with other antibiotics. Altemeier and associates[2] have emphasized the importance of varying susceptibility to different species of bacteria. Antibiotic resistant microörganisms may develop. Meleny and Johnson[34] have discussed the increasing resistance of bacteria to antibiotics and have stressed the importance of isolating the organisms causing infection and testing their sensitivity so that the most potent antibiotic may be employed. Dowling[15] and his co-workers stated that this defense reaction by bacteria may become an important problem in the control of infections. Thienes[56] has warned against the indiscriminate use of antibiotics. Emergency drugs should not be used where an emergency does not exist. Some believe we are working our therapeutic horse to death.

In the treatment of peritonitis there usually is an opportunity to study the types of bacteria responsible for the infection and enable the therapist to employ those antibiotics most suitable for the individual patient. Altemeier[3] has stated that penicillin in large doses is most effective. Penicillin and streptomycin have proved a good combination. Wright and co-workers[59] (1951) found aureomycin effective in controlling peritonitis due to mixed gram negative and gram positive flora. Since peritonitis rarely is caused by a single bacterium and bacteria vary much in their virulence, the proper antibiotic should be chosen to combat these factors, remembering the synergistic effect of many bacteria. Lockwood[30] believed that the sulfonamides, penicillin and streptomycin act by restraining growth of gram positive cocci which minimizes the toxic dose of toxic protein split products. These drugs apparently neutralize the action of

toxic bacterial proteins and encourage production of a fibrous barrier around a focus of infection.

The extensive studies of Altemeier,[4] Pulaski[49, 50] and Meleny[35] in the last 15 years have done much to clarify the antibiotic problem.

USE OF NARCOTICS

Morphine may be used in sufficient dosage to control pain and restlessness, relieve anxiety, and produce rest. It is doubtful if other narcotics have greater value than morphine. Paine and associates[46] (1933) noted that morphine in large doses tended to increase distention, but in moderate doses neither prevented nor relieved distention. They concluded that there was no prejudice against the use of morphine to relieve pain. It has been shown experimentally (1933) that moderate doses of morphine increase the tone of the bowel muscle and increase the amplitude of segmental movements.[44] Large doses decrease muscle tone. Morphine produces a spastic action of the sphincters and delays the passage of barium through the intestinal tract. It is suggested that morphine may cause or increase nausea and vomiting due to its tonic action on the pyloric sphincter. It is obvious that morphine should be discontinued in the treatment of peritonitis as soon as pain ceases to be a factor. Other sedatives then may be used to control restlessness.

OXYGEN THERAPY

Oxygen therapy may be indicated in the advanced stages of peritonitis. In 1932 Thalhimer[55] recommended the use of oxygen in concentrations of 50 to 60 per cent. Fine and associates[17] (1936) have observed, in their experiments, that high concentrations of oxygen promote absorption of gas from the distended intestine. In experiments on dogs, Paine and co-workers[47] (1941) concluded that prolonged use of 75 per cent oxygen would produce deleterious effects upon the liver, kidneys, and lungs, and 75 to 100 per cent oxygen caused death in dogs in an average of 37 hours. They believed, however, that 95 per cent oxygen could be used intermittently without danger. It probably is safer to give oxygen by nasal tube introduced into the nasopharynx at the rate of 6 liters per minute. It has been estimated that 50 to 60 per cent oxygen can be administered by nasal tube.

BED POSTURE

It is probable that the Fowler or semisitting position has little effect upon localizing peritoneal infections. However, it is possible that such postures may limit the spread of liquid exudates. The semisitting position will increase the vital capacity of the lungs and make the patient more comfortable. Its use seems advisable.

LOCAL APPLICATION OF HEAT

The local application of heat to the abdomen often is comforting to the patient. Just what effect it may have, if any, upon the peritoneal infection is diffi-

cult to determine. Experiments (1935) have shown that the intra-abdominal temperature can be raised slightly in children and in adults with thin abdominal walls.[9] In 1935 Ochsner[43] expressed the belief that heat applied to the abdomen stimulated peristalsis. The danger of heat therapy applied to the abdomen is almost nil if the skin is protected adequately against blistering. If it adds to the patient's comfort it should be used.

USE OF ENEMAS AND COLON TUBE

Enemas to reduce distention of the bowel due to gas have been used for many years. It once was believed that they might stimulate peristalsis in the small intestine. Experiments upon normal dogs (1935) have shown that enemas commonly used do not stimulate peristalsis in the small intestine.[45] When hypertonic solutions of sodium chloride are used peristalsis is stimulated. Hypertonic solutions produce too much local irritation to be of practical value. It is doubtful if any type of stimulation to increase peristalsis should be used in severe peritoneal infections.

Enemas should not be used when perforation of the appendix or a diverticulum is suspected. Portions of enemas have been found within the peritoneal cavity when these perforations existed. Small enemas may be used with caution to aid in expulsion of gas from the colon when there is no possibility of leakage into the peritoneal cavity and when peritonitis is subsiding. The use of the indwelling colon tube is safer than enemas and may be used if not too irritating to the patient.

USE OF DRUGS TO STIMULATE PERISTALSIS

There is no convincing evidence that the use of drugs to stimulate peristalsis at the height of peritoneal infection is of any value. They may do harm. Such treatment is hardly consistent with the belief that localization of peritoneal infections depends somewhat upon a quiet intestine. With our present methods of decompressing the intestine, which prevent overdistention and bowel wall damage during the height of infection, there is no need for the stimulation of peristalsis to remove the gas from the intestine.

TRAINING OF SURGEONS, ANESTHETISTS AND THE PUBLIC

The training of surgeons, anesthetists and the public has made great strides in the past 25 years. More and more young surgeons are taught to realize that operating is only a part of the surgeon's obligation in the treatment of surgical diseases. Formerly a knowledge of anatomy and pathology was the hallmark of a good surgeon. In recent years increased emphasis has been placed upon physiology and chemistry. What happens to patients in terms of metabolic changes is being taught and learned by the young surgeon. To put and keep the surgical patient in metabolic balance is being emphasized in experimental studies. By learning these things early, students, interns and residents are preparing themselves better for more scientific treatment of all diseases, both medical and surgical.

The training of anesthetists has kept pace with the training of surgeons. No longer is the anesthetist merely a technician to put the patient to sleep for the surgeon. He participates in the care of the patient by preoperative and postoperative study. The effects of anesthesia upon the physiology and chemistry of the patient is studied carefully.[22] New anesthetics are being introduced and evaluated. Close teamwork between the anesthetist and the surgeon has done much for the welfare of the patient. A greater number of anesthetists are initiating and participating in experimental work. Better anesthesia has had its part in the improvement of mortality rates.

The public is becoming more aware of the importance of the acute onset of disease, and the incidence of prolonged waiting and home therapy is being reduced. No longer is an acute abdominal pain a signal for catharsis, but a warning that a serious surgical disease may be developing. This attitude of an enlightened public has done much to prevent the development of such complications as acute peritonitis and undoubtedly has been a factor in lowering the mortality rate by preventing disease that might become lethal. But there have been, and probably always will be, economic problems, ignorance, wishful thinking, fear of surgical operations, and the inevitable *'lunatic fringe'* that will cause delay and needless deaths.

MORTALITY RATE

Many factors undoubtedly have been active in the reduction of the mortality rate in acute peritonitis. There is much statistical evidence to show that there has been a great decrease in mortality rate but no statistical evidence with which we may judge the importance of the prevention of peritonitis. That the incidence of peritonitis has been decreased by preventive measures is supported by the knowledge that nearly all mortality rates have decreased in the past 25 years.

Even though mortality rates are decreasing steadily there always will be an irreducible minimum mortality rate in acute peritonitis due to faulty diagnosis, delayed diagnosis and treatment, lack of skillful treatment, associated diseases of the cardiovascular, respiratory and renal systems, depleting diseases, injuries, age and other uncontrollable complications. This knowledge should not be used as an excuse for inefficient or ill-advised treatment, but accepted with regret that a cure may not always be possible with the best known treatment.

Following is some of the recent statistical evidence of the decrease in mortality rate in acute peritonitis.

1. Crile[12] (1946) treated 50 patients with peritonitis originating from appendicitis with massive doses of penicillin. There was one death in this series due to mesenteric thrombosis. 2. Schullinger[51] (1947), in a study of acute appendicitis at the Presbyterian Hospital in New York, found that the mortality rate in acute appendicitis with acute diffuse peritonitis for a 30 year period was 15.48 per cent. In the last five years of this period the mortality rate was reduced to 4.08 per cent. He remarked that there were many factors responsible for the lowered mortality rate, but perhaps the most important of all was the

sober judgment, skill and experience of the surgeon combined with his observance of fundamental precepts and sound surgical principles. 3. In 1949 Altemeier[3] discussed the treatment of acute peritonitis with and without the use of antibiotics. When the antibiotics were used the mortality rate in appendiceal peritonitis and abscess was reduced from 14.6 per cent to 4.9 per cent; in perforated ulcer from 26.6 per cent to 9.3 per cent; and in penetrating wounds of the abdomen from 27.9 per cent to 11.5 per cent. It was his opinion that successful management of acute peritonitis depended primarily upon good surgical intervention, aided by early and correct diagnosis, chemotherapy and adequate preoperative and postoperative care. He believed that the reduction in the mortality rate in the patients whose cases he reported was undoubtedly due to the use of effective antibacterial agents. 4. At the Harlem Hospital in New York, Wright and associates[59] (1951) studied the mortality rates in 235 patients with peritonitis for a two year period and compared them with the mortality rates of 234 patients in the preceding two year period. The groups included patients with appendicitis with perforation, perforated gastroduodenal ulcers, stab wounds, gunshot wounds, intestinal obstructions with perforations and resections, subcutaneous ruptures of the intestines and miscellaneous cases of viscus perforations. The mortality rate for the first two year period was 18.80 per cent compared to a 9.36 per cent mortality rate in the second two year period. He attributed the improvement in mortality rate to the use of aureomycin therapy. In the first two year period penicillin, streptomycin and sulfadiazine were the therapeutic agents used. He concluded that aureomycin is the antibiotic of choice in the therapy of peritonitis. 5. Goldenberg[20] reported (1954) the mortality rate in 177 patients with perforated peptic ulcer. Forty-four of these patients were treated in a 12 year period from 1928 to 1940 with a mortality rate of 16 per cent. In a 12 year period from 1941 to 1953 the mortality rate was 9 per cent. 6. Massie and Vance[38] (1954) reviewed the histories of 87 patients who had peritonitis due to perforations of the appendix. Sixty-seven patients had spreading peritonitis, 6 had generalized peritonitis and 14 had abscesses. There was one death—a mortality rate of 1.5 per cent.

CONCLUSIONS

In the past 25 years decompression therapy, restoration of metabolic balance and antibiotic therapy have improved the mortality rate for acute peritonitis more than any other methods of treatment.

Improved methods of preventing infection resulting from abdominal operations have done much to reduce the incidence of peritonitis.

There always will be an irreversible minimum in the mortality rate of acute peritonitis due to faulty diagnosis, and to such factors as age, obesity, advanced cardiovascular, renal and respiratory disease, and massive embolism. Lack of adequate supervision of the inexperienced surgeon by the experienced surgeon may contribute to an increased mortality rate.

In the study of antibiotic therapy there has developed, and still is developing, a better understanding of the increasing resistance of bacteria to anti-

biotics, the sensitivity of certain bacteria to the various antibiotics, the masking of infections by the use of antibiotics, the dangers of antibiotics, and the indications and contraindications for the use of these therapeutic agents in both prevention and treatment of infections. It is probable that further increase in the resistance of bacteria to the antibiotics will develop. To delay this tendency there must be greater discrimination in the selection and use of antibiotics. Undoubtedly new and more potent antibiotics will be developed to replace the old.

Our knowledge of disease becomes more complicated daily. It is predicted that there may come a time when a specialist in metabolism may become a necessary addition to the surgical team.

It is obvious that a knowledge of chemistry in the modern diagnosis and treatment of disease is rapidly growing in importance. It is equally obvious that the precepts of the new should not overshadow the established precepts of the old. The basic factor in good surgical treatment still is surgery. There is no substitute for good surgical judgment and good surgery in the prevention and treatment of peritonitis.

REFERENCES

1. Altemeier, W. A.: Pathogenicity of bacteria of appendicitis peritonitis, Surgery *11:* 374 (March) 1942.
2. Altemeier, W. A.: Inactivation of penicillin by various gram negative bacteria, Surg., Gynec. & Obst. *81:* 379 (Oct.) 1945.
3. Altemeier, W. A.: Treatment of acute peritonitis, J. A. M. A. *139:* 347 (Feb. 5) 1949.
4. Altemeier, W. A., Culbertson, W. R., Sherman, R., and Elstun, W.: Critical re-evaluation of antibiotic therapy in surgery, J. A. M. A. *157:* 305 (Jan.) 1955.
5. Beal, J. M., Frost, P. M., Smith, J. L., and Felts, M. A.: Influence of caloric and potassium intake on nitrogen retention in man, Ann. Surg. *138:* 842 (Dec.) 1953.
6. Berry, R. E. L., Iob, V., and Campbell, K. U.: Potassium metabolism in immediate postoperative period, Arch. Surg. *57:* 470 (Oct.) 1948.
7. Cannon, P. R., Frazier, L. E., and Hughes, R. H.: Influence of potassium on tissue protein synthesis, Metabolism *1:* 49 (Jan.) 1952.
8. Cantor, M. O.: New simplified intestinal decompression tube, Am. J. Surg. *72:* 137 (July) 1946.
9. Carlson, H. E., and Orr, T. G.: Penetration of moist heat applied to abdomen and its effect upon intestinal movements, Arch. Surg. *30:* 1036 (June) 1935.
10. Cole, W. H.: Problems in operability. A Sir Thomas Dixon lecture, Bull. Am. Col. Surg. *40:* 41 (Jan.–Feb.) 1955.
11. Coller, F. A., and Maddock, W. G.: Water and electrolyte balance. Surg., Gynec. & Obst. *70:* 340 (Feb. 15) 1940.
12. Crile, G., Jr.: Peritonitis of appendiceal origin treated with massive doses of penicillin, Surg., Gynec. & Obst. *83:* 150 (Aug.) 1946.
13. Curreri, A. R., Schmidt, E. R., and Mendenhall, J. T.: Role of antibiotics in masking inflammatory processes, Arch. Surg. *57:* 513 (Oct.) 1948.
14. Domagk, G.: Eine beitrag zur chemotherapie der bacteriellen infectionen, Deutsche med. Wchnschr. *61:* 250 (Feb. 15) 1935.
15. Dowling, H. F., Lepper, M. H., and Jackson, G. G.: Clinical significance of antibiotic-resistant bacteria, J. A. M. A. *157:* 327 (Jan. 22) 1955.
16. Elman, R., and Akin, J. T., Jr.: Design for surgical convalescence, Ann. Surg. *122:* 716 (Oct.) 1945.
17. Fine, J., Banks, B. M., Sears, J. B., and Hermanson, Z.: Treatment of gaseous distention of intestine by inhalation of 95 per cent oxygen: description of apparatus for clinical administration of high oxygen mixtures, Ann. Surg. *103:* 375 (March) 1936.
18. Fleming, A.: On antibacterial action of cultures of penicillin with special reference to their use in isolation of B. influenzae, Brit. J. Exp. Path. *10:* 226 (June) 1929.
19. Fowler, E. F., and Bollinger, J. A.: Appendicitis, antibiotics and surgical drainage, Am. Surgeon *19:* 858 (Sept.) 1953.
20. Goldenberg, I. S.: Surgical therapy of acute perforated peptic ulcer, Am. Surgeon *20:* 1258 (Dec.) 1954.

21. Haden, R. L., and Orr, T. G.: Effect of sodium chloride on chemical changes in blood of dog after pyloric and intestinal obstruction, J. Exp. Med. *38:* 55 (July) 1923.
22. Hayes, M. A., and Coller, F. A.: Neuroendocrine control of water and electrolyte excretion during surgical anesthesia, Surg., Gynec. & Obst. *95:* 142 (Aug.) 1952.
23. Haynes, B. W., Jr., Crawford, E. S., and DeBakey, M. E.: Magnesium metabolism in surgical patients, Ann. Surg. *136:* 659 (Oct.) 1952.
24. Hardy, J. D.: Fluid Therapy. Philadelphia, Lea & Febiger, 1952.
25. Hibbard, J. S., and Wangensteen, O. H.: Character of gaseous distention in mechanical obstruction of small bowel, Proc. Soc. Exp. Biol. and Med. *3:* 1060 (June) 1934.
26. Layne, J. A., Schermm, F. R., and Camara, A. A.: Importance of simultaneous correction of plain water deficits and extracellular fluid volume loss when replacing fluid and electrolyte loss from gastrointestinal tract, Gastroenterology *27:* 531 (Nov.) 1954.
27. Lazarus, E. E., Baum, V., and Breidenbach, L.: Modern concepts of intraperitoneal drainage, Surg., Gynec. & Obst. *98:* 506 (April) 1954.
28. Levin, A. L.: New gastroduodenal tube, J. A. M. A. *76:* 1007 (April 9) 1921.
29. Linder, F.: Nebenwirkungen der antiobiotica in der chirurgie, Der Chirurg. *26:* 7 (Jan.) 1955.
30. Lockwood, J. S.: Discussion of Schullinger's paper, Ann. Surg. *126:* 470 (Oct.) 1947.
31. Maddock, W. G., and Coller, F. A.: Sodium chloride metabolism of surgical patients, Ann. Surg. *112:* 521 (Oct.) 1940.
32. Massie, R. M., Jr., and Vance, J.: Treatment of perforated appendicitis, Am. Surgeon *20:* 1194 (Nov.) 1954.
33. Matas, R.: Continuous intravenous drip; with remarks on value of continued gastric drainage and irrigation by nasal intubation with a gastroduodenal tube (Jutte) in surgical practice, Ann. Surg. *79:* 643 (May) 1924.
34. Meleny, F. L., and Johnson, B. A.: Clinical significance of increasing resistance of organisms to antibiotics, Surg., Gynec. & Obst. *97:* 267 (Sept.) 1953.
35. Meleny, F. L.: Past 50 years in management of surgical infections, Surg., Gynec. & Obst. Internat. Abstracts of Surg. *100:* 1 (June) 1955.
36. Mersheimer, W. L., and Miller, E. M.: Diffuse peritonitis secondary to intestinal perforation complicating malignant lesions of colon, Surg., Gynec. & Obst. *99:* 436 (Oct.) 1954.
37. Miller, T. G., and Abbott, W. O.: Intestinal intubation: a practical technique, Am. J. M. Sci. *187:* 595 (May) 1934.
38. Moore, F. D., Haley, H. B., Bering, E. A. Jr., Brooks, L., and Edelman, I. S.: Further observations on total body water; changes of body composition in disease, Surg., Gynec. & Obst. *95:* 155 (Aug.) 1952.
39. Moore, F. D., and Ball, M. R.: The Metabolic Response to Surgery, Springfield, Charles C Thomas, 1952.
40. Moretz, W. H., and Erickson, W. G.: Peritoneal tap as an aid in diagnosis of acute abdominal disease, Am. Surgeon *20:* 363 (April) 1954.
41. Moyer, C. A.: Fluid Balance: A Clinical Manual. Chicago, Year Book Publishing Co., 1952.
42. Ochsner, A., and Granger, A.: Roentgen diagnosis of ileus, Ann. Surg. *92:* 947 (Nov.) 1930.
43. Ochsner, A.: Postoperative treatment based on physiologic principles, South. Surgeon *4:* 197 (June) 1935.
44. Orr, T. G., and Carlson, H. E.: Effect of morphine on movements of small intestine and sphincter muscles, Arch. Surg. *27:* 296 (Aug.) 1933.
45. Orr, T. G., and Carlson, H. E.: Effect of enemas upon intestinal motility, Arch. Surg. *31:* 881 (May) 1935.
46. Paine, J. R., Carlson, H. A., and Wangensteen, O. H.: Postoperative control of distention, nausea and vomiting; clinical study with reference to employment of narcotics, cathartics and nasal catheter suction-siphonage, J. A. M. A. *100:* 1910 (June 17) 1933.
47. Paine, J. R., Lynn, D., and Keys, A.: Observations on effects of prolonged administration of high oxygen concentration in dogs, J. Thoracic Surg. *11:* 151 (Dec.) 1941.
48. Paine, J. R.: Role of gastrointestinal decompression in surgery, Surgery *36:* 850 (Oct.) 1954.
49. Pulaski, E. J., Noyes, H. E., Evans, J. R., and Brame, R. A.: Influence of antibiotics on experimental endogenous peritonitis, Surg., Gynec. & Obst. *99:* 341 (Sept.) 1954.
50. Pulaski, E. J.: Surgical Infections, Prophylaxis, Treatment and Antibiotic Therapy. Springfield, Ill., Charles C Thomas, 1954.
51. Schullinger, R. N.: Observations on mortality from acute appendicitis at a university hospital, 1916 to 1946, Ann. Surg. *126:* 448 (Oct.) 1947.
52. Statland, H.: Fluids and Electrolytes in Practice, Philadelphia, J. B. Lippincott Company, 1954.
53. Selye, H.: Alarm reaction, Canad. M. Asso. J. *34:* 706 (June) 1934.

54. Selye, H.: General adaptation syndrome and diseases of adaptation, J. Clin. Endocrinology *6:* 117 (Feb.) 1946.
55. Thalhimer, W.: When is oxygen therapy indicated and how is it best given? Mod. Host. *38:* 105 (Feb.) 1932.
56. Thienes, C. H.: Drug fastness in relation to sulfonamides and antibiotics, Ann. West. Med. and Surg. *3:* 296 (Aug.) 1949.
57. Ward, R.: An apparatus for continuous gastric or duodenal lavage, J. A. M. A. *84:* 1114 (April 11) 1925.
58. Wangensteen, O. H.: Early diagnosis of acute intestinal obstruction with comments on pathology and treatment: with a report of successful decompression of three cases of mechanical obstruction by nasal catheter suction drainage, Trans. West. Surg. Asso. p. 483, 1931.
59. Wright, L. T., Schreiber, H., Metzger, W. I., and Packer, J. W.: An evaluation of aureomycin therapy in peritonitis, Surg., Gynec. & Obst. *92:* 661 (June) 1951.

RIEDEL'S THYROIDITIS: A REVIEW OF ITS CONCEPT

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The thyroid gland has been the subject of scientific interest and inquiry for many years and, while there have been noteworthy physiologic advances, the pathogenesis of most of its diseases remain an enigma. Striking examples are those diseases included under the general classification of thyroiditis. Included in this category are subacute, granulomatous, chronic, Hashimoto's and Riedel's thyroiditis. Confusion and controversy exist, not only over the etiology of these entities, but also over their relationship and even pathologic identification.[18] This particularly is true of Riedel's thyroiditis.

A survey of the clinical experience of one of us (R. B. M.) during the past 20 years disclosed 27 patients in whom a diagnosis of Riedel's thyroiditis had been made on a pathologic basis. This seemed to be such an unusual experience[11, 14] that we have elected to review our findings in these patients in conjunction with the general concept of this disease.

The concept of Riedel's thyroiditis was based upon 3 cases personally observed and documented by Riedel.[20, 21, 22] His first patient was a man 42 years of age who had noticed the gradual onset (six months) of a symmetrical goiter characterized by its hardness and association with slight dyspnea. Operation in this patient had to be abandoned because of *inoperability*. Following improvement for approximately nine months, he developed nephritis and died after his fourth cerebral hemorrhage. The second patient was a woman of 23 years who noted an asymmetrical enlargement of the thyroid of approximately six months duration. The symptoms primarily were dyspnea, dysphagia and again the goiter was characterized by its hardness. On examination of the right side of the thyroid an egg-sized tumor was found, and on the left side there was one the size of a small apple. Operation upon this patient had to be discontinued because of extensive adhesions between tumor, blood vessels and nerves. The patient died two months following operation from what seemed to be a pulmonary embolus. The third patient was a man of 29 years, previously in good health, who noted the sudden onset (four weeks) of a hard asymmetrical goiter on the right side that gradually extended to the left. Dyspnea was his primary complaint. Attempt at removal was unsuccessful, and later, because of increasing dyspnea, a resection of the isthmus was done. Resolution of the goiter occurred during the ensuing nine months and there was no recurrence within the next 14 years. In none of these patients was an autopsy done. Riedel described the operative find-

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FIG. 1

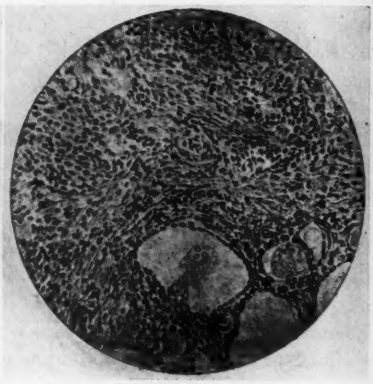


FIG. 2

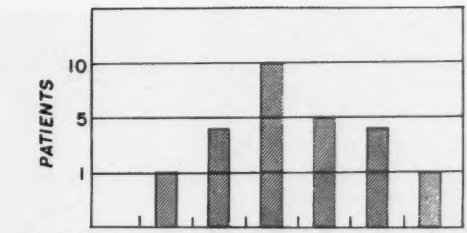
FIG. 1. Histologic appearance of Riedel's first case. Note similarity to figure 7
FIG. 2. Histologic appearance of Riedel's second case.

ings in these patients as follows: "The great vessels appeared to be encased in scar tissue. One can cut through them from above and below, but it is impossible to separate them from the tumor. Recurrent nerves are embedded in scar and scarcely can be identified. The trachea is so softened that one can imagine it to be already perforated. Even the most malignant tumor is easier to separate than such a chronic inflammatory mass."[20]

Pathologic examination in the first patient disclosed a diffuse infiltration of round cells in normal thyroid tissue which seemed to be more or less destroyed by these round cells. In the other 2, biopsy disclosed predominantly spindle and round cells between normal elements of goiter, the latter becoming more and more displaced. Only two photomicrographs accompanied these reports and their relationship to the patients is not clear (figs. 1, 2).[20]

Based upon these rather meager descriptions as well as conflicting pathologic findings, there has developed the entire concept of Riedel's thyroiditis. Although some individuals have listed rather rigid criteria for diagnosis,[13, 25] others recognize variants of the disease.[8, 10, 11, 17, 19, 23]

At present, the commonest description[13] is that of a lesion occurring more commonly in males than in females, usually in the fourth decade of life, characterized by dense and constricting cicatrix involving the thyroid gland and contiguous structures and associated with severe pressure symptoms. Part or all of the gland may be involved. There usually are no accompanying metabolic abnormalities. The pathologic criteria predominantly are those of dense scar. In many reports, however, it was recognized that there were variants of this disease both in the clinical and pathologic aspects. Thus, pain and tenderness in the region of the thyroid become included in the clinical picture and the predominance in males is not particularly striking.[8, 19, 23] Also included among the pathologic features are *pseudo-tubercles* or granulomas. These were described as consisting of a varying number of giant cells, acute cellular destruction and



"Reidel's" Thyroiditis

FIG. 3

DURATION OF SYMPTOMS	
< 1 month	7
1-2 months	17
2-3 months	1
> 6 months	2

FIG. 4

PRESENTING COMPLAINTS	
Goiter	10
Pain	8
Constriction	6
Nervousness	4

FIG. 5

CHARACTER OF THYROID	
Diffuse enlargement	19
Unilateral enlargement	4
Nodular enlargement	4

FIG. 6

cellular atrophy in association with fibrosis. DeQuervain, however, placed these lesions in a category of subacute thyroiditis and considered this a separate entity of nonspecific etiology.[7] More recently, the term Riedel's thyroiditis has been reserved for those glands with degenerating involutionary nodules surrounded by proliferating fibrous tissue which characteristically involve surrounding structures in the neck.[6, 15]

A review of our patients disclosed them to fall in that group that has been called Riedel's thyroiditis—giant cell variant.[23] Pathologically, they are characterized by a progressive thyroiditis with regenerating thyroid epithelium in dense scar as the end result. These patients predominantly were females (25 of 27) in their fourth decade (fig. 3) with symptoms of less than two months duration (fig. 4), namely, goiter, pain in the neck, a sense of constriction—dysphagia, chokiness or tightness, and in a few, nervousness (fig. 5). There was a singular absence of preceding infection and only 5 had a history of a previous thyroid disorder. Significant alteration in the metabolic status, except for a slight weight loss, was absent by history, physical examination and laboratory findings. The thyroid gland usually was diffusely enlarged (fig. 6)—2 to 4 times—firm to hard in consistency, and occasionally tender on palpation. At operation the thyroid was firm to hard, usually gray on cut section, with evidence of pericapsular inflammation. Occasionally contiguous muscle was involved. In all but 3 patients in whom more extensive resections were done, the isthmus with a small portion of the adjacent lobes was removed as an excisional biopsy.

No specific treatment was carried out postoperatively except for the administration of thyroid ½ to 1 gr. daily which was required for 10 patients. There was ultimate decrease in size of the thyroid and subsidence of symptoms.

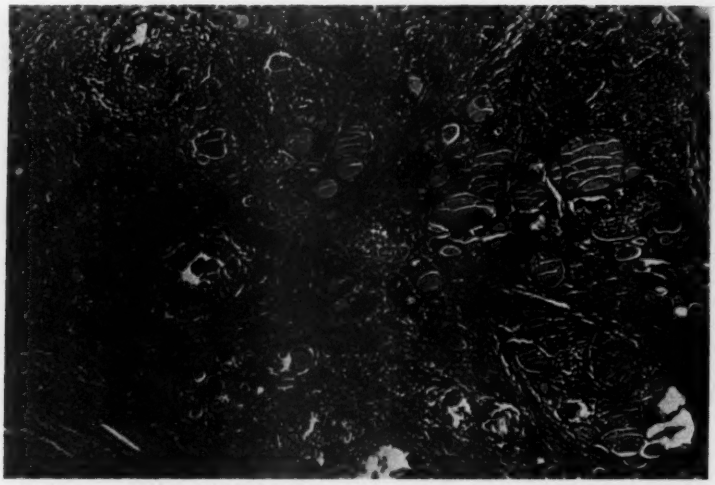


FIG. 7. Protean nature of inflammatory changes are demonstrated by well preserved acini, evidence of acute inflammation, lymphocytic infiltration and fibrosis. ×10

Thus, we have a group of patients—predominently females—in their third to fifth decade with recent awareness of thyroid enlargement, pain in this area and a sense of constriction in the neck. The thyroid usually was hard, diffusely enlarged and accompanied by little alteration in metabolic state.

Pathologic examination disclosed striking variations in the histologic picture (fig. 7) but many features in common. Most frequent was the finding of varying degrees of fibrous tissue proliferation. Equally impressive were the acute and chronic phases of inflammation scattered throughout the gland. Both early and late phases of cellular injury were seen frequently in adjacent areas. Several had areas in which the infiltration of lymphoid tissue and loss of normal architecture were sufficient to fulfill the usual criteria for Hashimoto's disease.[15] Colloid nodules also were seen, normal in appearance and contiguous to the inflammatory changes in the thyroid. Evidence of hyperplasia, except for those areas showing regeneration, seemed to be unusual. The over-all picture was one of acute and chronic inflammation of portions of the thyroid with other areas appearing uninvolved. The inflammatory changes varied from the infiltration of polymorphonuclear leukocytes and lymphocytes, to the participation of mononuclear phagocytes, multinucleated giant cells and ingrowing fibroblasts. Areas of epithelial regeneration, fibrous tissue maturation and loss of lymphocytes also were seen in the older lesions.

Although not every phase of activity is seen in one gland, it is possible by a survey of all the pathologic material, to reconstruct the general course of the disease. The earliest evidence of injury appears to be acute disruption of the follicle with loss of the follicular epithelium and colloid, and infiltration with acute inflammatory cells. Such a lesion may occur with normal surrounding

FIG. 8. Early lesion in normal parenchyma with loss of follicular epithelium and infiltration of acinus by acute inflammatory cells. ×33

follicles (fig. 8) or in an area where other follicles previously have been destroyed and partially replaced by scar and lymphocytes (fig. 9). The infiltration of inflammatory cells is followed immediately by the ingrowth of fibroblasts, probably arising from the multipotential lymphocytes. In other instances, the initial reaction is less violent with minimal inflammatory exudate but with desquamation of follicular epithelium and apparent infiltration and engulfment of colloid by mononuclear cells. Again, this lesion may appear in an area of normal thyroid or in conjunction with older lesions. These protean histologic findings probably are related to the cyclic physiologic activity of the thyroid.

In still later phases, multinucleated giant cells appear at the margins of the damaged follicle and appear to be phagocytizing colloid. These most likely are foreign body cells of the Langhans variety rather than degenerating conglomerants of sloughing epithelial cells. This is the type of reaction anticipated from lipids and has been demonstrated to occur in the experimental animal.[9] For these multinucleated cells to represent a conglomerate of desquamating epithelial cells would seem unlikely, for a loss of cell membrane usually is associated with cell death. Furthermore, from our knowledge of radiation damage to the thyroid,

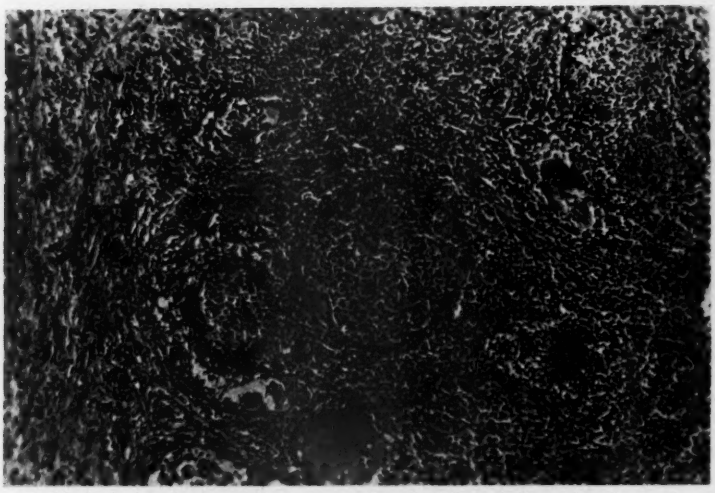


FIG. 9. Early lesion in area where more chronic inflammation already predominates. Phagocytic monocytes are infiltrating the follicles at lower margin of field. ×33

sloughing epithelium does not assume the appearance of such giant cells. It is not, however, a mere matter of mechanical disruption of the follicle with resulting reaction to the extravasated colloid.[12] Chesky and associates have explained these findings on the basis of a change in composition of colloid and ingestion of colloid by invading macrophages. Upon returning to the interfollicular stroma, the macrophages disintegrate, release colloid, resulting in the reaction of *chronic thyroiditis*.[2]

Coincidentally with acute acinous disruption there are inflammatory changes in the perifollicular stroma. At times, there appears to have been previous injury to such areas because of the fibrosis and lymphocytic infiltration already in evidence.

Repair of these injuries of the thyroid follicle commences immediately. And just as there are all stages of acute inflammation present in the same gland, all stages of repair also can be seen. Fibrous tissue proliferation occurs even before the colloid is completely gone. As repair continues, evidence of residual or regenerating follicular epithelium is noted, seeming to make abortive attempts at acinous formation. These epithelial cells still may be surrounded by lymphocytes and embedded in maturing fibrous tissue (fig. 10). With maturation of the process, there are fewer inflammatory cells and the epithelial cells are embedded in scar tissue alone. Initially, there seems to be little evidence of colloid formation but later with the formation of lumina, small quantities of colloid may be seen. This end result of intense interlobular and intralobular scarring with many small regenerated follicles (fig. 11) has been described as Riedel's struma.[23]

In other instances, there seems to be few or no surviving epithelial elements, only diffuse inflammatory cells in dense cicatrix. Further resolution here is

FIG. 10. Initial stage of repair is characterized by lymphocytic infiltration about regenerating thyroid epithelium and maturing fibrous tissue. ×33

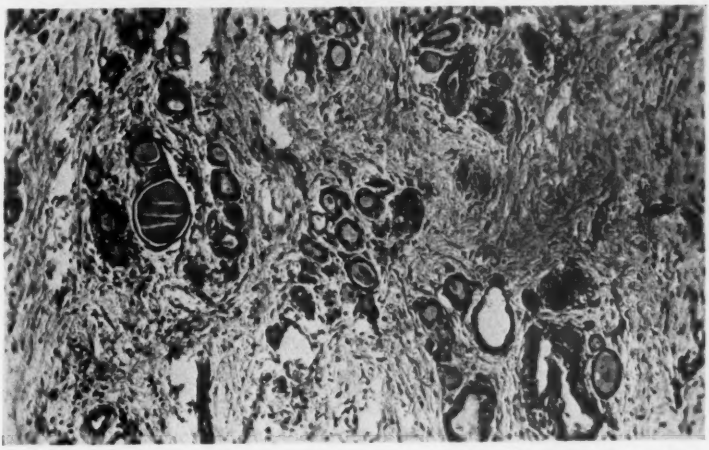


FIG. 11. Late stage of repair demonstrates regenerated and/or preserved colloid containing acini in dense fibrous stroma. ×33

characterized by disappearance of the inflammatory cells and the end result is mature scar tissue (fig. 12)—the classic finding of *Riedel's thyroiditis*.

In addition to the phasic nature of the inflammatory reaction, we also have been impressed by the occasional involuting or inactive colloid nodule that may be surrounded by this process and yet seems to escape any evidence of cellular injury (fig. 13). We do not believe that the changes in the adjacent parenchyma

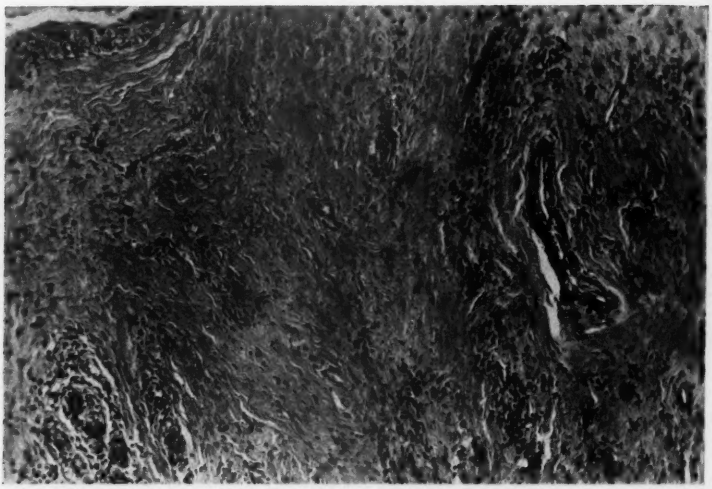


FIG. 12. End result of severely injured area shows only dense scar. Note vessel changes in upper left. ×33

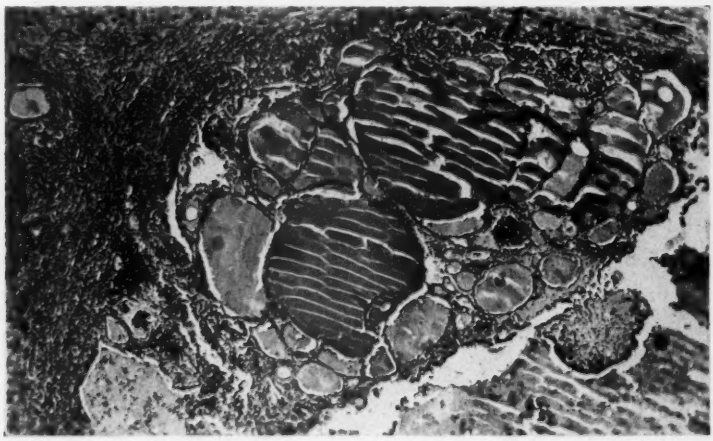


FIG. 13. Involutionary nodule that has escaped injury, whereas contiguous gland was severely damaged. ×33.

are incident to the degenerating nodule,[6] but rather that this nodule, being metabolically quiescent or inactive, did not take part in the generalized inflammatory changes throughout the gland.

COMMENT

Theories as to pathogenesis of subacute and chronic thyroiditis have been postulated primarily on clinical observations since there has been little supportive

experimental work. The general histologic pattern is one of long standing and continual insult to the thyroid epithelium, resulting in injury and degeneration of the most physiologically active acini. Those cells having the highest rate of metabolism would appear to be more susceptible to injury, regardless of the cause. Thus, the well known cyclic functional activity of the thyroid would account for all phases of inflammation being present at one time. Furthermore, the older the process, the more likely there would be increasing degrees of fibrosis. Unfortunately, while there have been a number of serial biopsies on patients with Hashimoto's disease, there have been almost none on other forms of thyroiditis so that such a progression is not well documented.

From our knowledge of the physiology of the thyroid and its response to severe stress, it seems unlikely that there is one etiologic agent responsible for these inflammatory changes. Following acute infections and toxemias, the loss of thyroid epithelium and desquamation of acinar cells has been described with similar changes being provoked in the experimental animal.[5] Degenerative changes also have been noted following chronic debilitating diseases such as tuberculosis, carcinomatosis and leukemia.[23] Chemical poisons, such as phosphorous and silver nitrate, also have provoked acinar degeneration and epithelial desquamation, in conjunction with acute and chronic cellular infiltration.[23] Under these varying conditions the effect on the thyroid probably is by direct toxic insult and indirectly through the increased functional activity of the thyroid during the systemic response to bodily stress.

Once acinar degeneration is initiated from whatever cause, local reaction to extravasated colloid and disintegrating epithelial cells contributes to the pathologic picture. A foreign body type of reaction can be anticipated in response to the contained lipid. Furthermore, extracts from human thyroglobulin placed in subcutaneous tissue of the experimental animal excites a reaction characterized by foreign body giant cell, proliferation of fibroblasts and the absence of necrosis.[9] Crystalline thyroxine will do the same.[4]

Although attempts to demonstrate a viral etiology by animal inoculation have been unsuccessful and no inclusion bodies have been identified, such a specific etiology cannot be completely excluded.

It also has been demonstrated that in some experimental animals, antithyroid blocking agents appear capable of producing fibrolymphoid changes and later dense scar, characteristic of struma fibrosa.[3] Although such changes have not been observed in the human being, it may be that the periods of observation have not been adequate. The irradiation changes following I^{131} have been more characteristic of Hashimoto's thyroiditis than the inflammatory changes that we have described. Epithelial desquamation and acinar degeneration do occur, but acute inflammatory and giant cell reactions are not common.[16] Intense fibrosis is seen as an end result, but much more hyalinization with a less dense scar are conspicuous features.

Studies on patients with Hashimoto's disease indicate that, although varying degrees of fibrosis may be present, this lesion usually does not terminate as a diffuse fibrosis of the thyroid. Several biopsies on patients at intervals from 14

months to 13 years have for the most part shown no essential change.[24] Whether this form of thyroiditis represents still another type of response of the thyroid to injury or is an entirely separate entity cannot be proved at the moment. Certainly these pathologic findings frequently are seen as focal changes accompanying other thyroid disorders and its association with adrenal insufficiency has been noted by several.[1, 25]

It should be apparent that while there are many etiologic agents involved in injury to the thyroid gland, the response to injury is fairly characteristic. The morphologic changes will vary with the functional activity of the thyroid, the presence of previous disease and upon the nature, intensity and duration of the stress. Recovery from such an injury may be complete but more commonly will be manifest by varying degrees of epithelial regeneration and fibrous tissue formation. Thus, the chief pathologic finding in the thyroid on autopsy is diffuse and dense scarring.[5]

The histologic picture of Riedel's thyroiditis, if the criterion of dense scar be employed, then is seen under many different circumstances and such a diagnosis cannot be made on a pathologic basis.

SUMMARY

In summary, the course of injury and repair in the thyroid is described. In our patients it was characterized by an initial acute inflammatory cellular infiltrate to what probably is a degenerative phenomenon on the part of the thyroid acini. There follows a foreign body response and more chronic inflammatory changes with the ultimate picture consisting of fibrosis and varying degrees of epithelial regeneration. The end result of such a process is that of intense fibrosis containing remnants of regenerated thyroid acini. Such a picture is not a specific disease entity but may be the result of many types of thyroid injury. With such a concept, Riedel's thyroiditis cannot represent a pathologic entity. If the term is retained at all, it should be a clinical diagnosis reserved for the occasional patient who has the operative findings similar to those described by Riedel.

REFERENCES

1. Bloodworth, J. M., Kirkendahl, W. M., Carr, T. L.: Addison's disease associated with thyroid insufficiency and atrophy (Schmidt's Syndrome), J. Clin. Endocrinol. *14:* 540 (May) 1954.
2. Chesky, V. E., Dreese, W. C., and Hellwig, C. H.: Supravital studies of surgical goiter specimens, Surg., Gynec. & Obst. *93:* 575 (Nov.) 1951.
3. Claussen, H. J.: Experimental production of struma fibrosa, A.M.A. Arch. Path. *58:* 222 (Sept.) 1954.
4. Clemencon, G.: Nachweis einer thyroxin-kristall-suspension in gewebe mit Berucksichtigung der histologischen reaktion, Acta Endocrinologia, *14:* 189 (Nov.) 1953.
5. Cole, W. H., Womack, N. A., and Gray, S. H.: Thyroid in infections and toxemias, Am. J. Surg. *6:* 221 (Feb.) 1929.
6. Crile, G., Jr.: Thyroiditis, Ann. Int. Med. *37:* 519 (Sept.) 1952.
7. DeQuervain, F., and Giordanengo, G.: Die akute & subakute inchteitrige thyroiditis, a.d. Greuzeb., Med. und Chir. *44:* 538, 1935-37.
8. Ewing, J.: Neoplastic Diseases, ed. 2, Philadelphia, W. B. Saunders Co., 1922, 1936, p. 961.
9. Ferguson, J. A.: Tissue reaction to colloid & lipoids from human thyroid gland, A.M.A. Arch. Path. *15:* 244 (Feb.) 1933.
10. Graham, A., and McCullagh, E. P.: Atrophy and fibrosis associated with lymphoid tissues in thyroid, A.M.A. Arch. Surg. *22:* 548 (April) 1931.

11. Herz, J.: On Goiter and Allied Diseases, Einar Munksgaard, 1943.
12. Jenkins, S. G., Jr., and Thomas, C. G., Jr.: Unpublished data.
13. Joll, C. A.: Pathology, diagnosis and treatment of Hashimoto's disease, Brit. J. Surg. *27:* 351 (Oct.) 1939.
14. Leavitt, T.: Status of lymphadenoid goiter, Hashimoto's and Riedel's Diseases, Ann. Royal Coll. Surgeons *10:* 369, 1952.
15. Lindsay, S., and others: Chronic thyroiditis; clinical and pathological study of 354 patients, J. Clin. Endocrinol. *12:* 1578 (Dec.) 1952.
16. Lindsay, S., Dailey, M. E., and Jones, M.: Histologic effects of various types of ionizing radiation on normal and hyperplastic human thyroid glands, J. Clin. Endocrinol. *14:* 1179 (Oct.) 1954.
17. McClintock, J. C., and Wright, A. M.: Riedel's struma and struma lymphomatosa (Hashimoto's disease), Ann. Surg. *106:* 11 (July) 1937.
18. McKnight, R. B.: Unpublished data of personal survey on thyroiditis.
19. McKnight, R. B.: Riedel's thyroiditis, South. Surgeon *5:* 375 (Oct.) 1936.
20. Riedel, B. M. C. L.: Die chronische zur bildung eisenharter tumaren fuhrende entzundung der schildrase, Vnhandl. d. deutsch. Gesselsch. f. Chir. *25:* 101, 1896.
21. Riedel, B. M. C. L.: Vorstellung eines kranken mit chronischer strumitis, Vnhandl. d. deutsch. Gesselsch. f. Chir. *26:* 127, 1897.
22. Riedel, B. M. C. L.: Ueber verhauf und ausgang den strumitis chronica, Munchen Med. Schnschr *57:* 1910, 1946.
23. Schilling, J. A.: Struma lymphomatosa, struma fibrosa and thyroiditis, Surg., Gynec. & Obst. *81:* 533 (Nov.) 1945.
24. Statland, H., Wasserman, M. M., and Vicker, A. L.: Struma lymphomatosa 'Hashimoto's Struma), A.M.A. Arch. Int. Med. *88:* 659 (Nov.) 1951.
25. Womack, N. A.: Thyroiditis, Surgery *16:* 770 (Nov.) 1944.

PRESACRAL EPIDERMOID CYST*

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During the early complex evolution of the embryo developmental errors in the region of the coccyx and sacrum result in a variety of neoplasms. Of these, benign congenital sequestrating epidermoid cysts, which usually are located in the presacral space, are common. Because of their rarity our experience with 8 cases will be described, with particular emphasis on the diagnostic and therapeutic problems involved in management.

EMBRYOLOGY

The exact derivation of presacral epidermoid cysts is somewhat obscure. Ewing[2] believed that they are derived from vestigial remnants of the neurenteric canal, the postanal gut or the proctodeal membrane. Like all monogerminal dermoids, they are situated in lines where, during embryonic life, epithelial surfaces coalesce, and the contents and presence and character of hair will correspond to the region affected.[2] According to Melody,[5] Scarborough believed that presacral epidermoid cysts develop from an offshoot of cells from the primitive anal plate which are detached when the plate undergoes canalization. Our experience supports this view.

ANATOMY OF PRESACRAL SPACE

The presacral space, which is the tissue plane between the sacrum and rectum, is converted into an actual space when a neoplasm or suppurative process displaces the rectum from the presacral fascia (fig. 1). This potential space is bounded anteriorly by the mesorectum and rectum in the midline, anterolaterally by the rectal stalks, posteriorly by the sacrum and coccyx, and posteroinferiorly by the ligamenta anococcygeum, levator ani and coccygei muscles. The proximal limitation generally is referred to as the level where the peritoneum is reflected from the rectum. Potentially, the superior limits may extend retroperitoneally to the diaphragm as demonstrated in presacral pneumography. The space contains the sacral plexus and branches of the sympathetic nervous system, middle sacral and lateral sacral arteries.

INCIDENCE

Neoplasms of the ventral region of the sacrum are rare. Colbert[1] found only one sacral tumor in 34,582 newborns. However, a number have been reported in adults. Between 1947 and 1954, 8 cases of presacral epidermoid cysts were encountered in 32,651 proctologic examinations at the Ochsner Clinic. Some authors state that presacral epidermoids occur only in the female. Although

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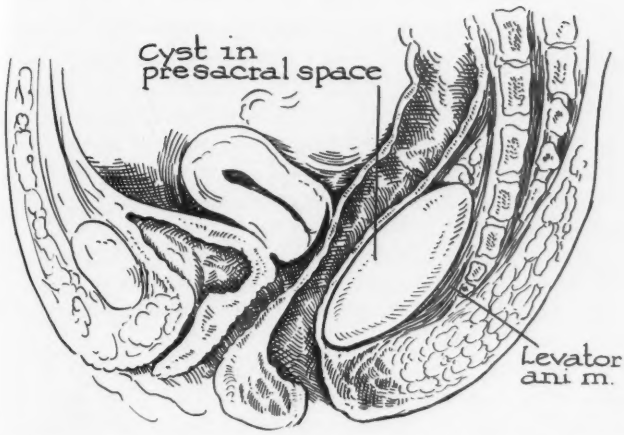

FIG. 1. Diagrammatic illustration of usual location of epidermoid inclusion cyst in the presacral space.

they rarely are encountered in the male, a cursory review of the literature revealed 14 cases, and 4 of our 8 patients were men.

SYMPTOMS

Most uncomplicated epidermoid cysts produce no symptoms and patients may be unaware of their presence. With time, however, the cyst may become so large that it causes an indefinite dull ache or pain in the lower part of the back or perineum. In its growth it may extend downward and protrude under the skin between the anus and coccyx, anal canal, perineum, or vagina causing numbness or an uncomfortable feeling when the patient is sitting. It may extend upwards into the pelvis causing pain in the right lower abdominal quadrant.[4] Constipation, rectal pressure and pelvic discomfort are common. Although these cysts are directly anterior to the sacral plexus, neurologic symptoms are absent.

Because of the sparse blood supply to these tumors and because of their location, which predisposes to trauma, as well as the possibility of the cyst being connected to the anal canal by a patent congenital sinus, infection is common. The symptoms produced by an infected cyst are identical with those of abscesses in the supralevator space, that is, fever, chills or chilliness, feeling of fullness in the rectum and commonly acute urinary retention. Pain is not a prominent complaint until the suppurative process descends to involve the ischioanal spaces. The abscessed cyst will rupture spontaneously if not surgically drained. The abscess usually dissects downward rupturing externally usually between the anus and the coccyx. Once infected and a sinus tract established, the stubborn persistence of the suppurative process manifests itself either by a purulent exudate draining constantly from the sinus, or by periodic recurrent abscesses until the cyst is completely extirpated.

DIAGNOSIS

The diagnosis of presacral epidermoid cyst is largely dependent upon the mindfulness of this entity during rectal digital examination, for a large percentage of cysts are asymptomatic, being discovered incidentally during routine physical examination or during the progress of labor. The possibility of its presence is further strengthened if a complicated or inexplicable para-anal sinus or sinuses are present. Such sinuses usually are single but may be multiple. Hair may protrude through the anus.

In newborns with a congenital draining sinus near the anus and in adults who have had multiple unsuccessful fistulectomies or who have a bulging or lump near the coccyx or anus the possibility of a dermoid cyst should be considered.

On digital rectal examination most noninfected epidermoids can be felt in the presacral space above the levator ani muscle (fig. 1 case 3). The mass displaces the rectum anteriorly. Usually the cyst is symmetrical; has a smooth surface and at times is so tense that fluctuation is difficult to elicit. Lobulation due to daughter cysts may be present. In our patients the cysts were fixed at the extreme lower anterior aspect to the anorectum, preventing upward displacement during palpation. However, superiorly the cystic dome is not attached and can be moved slightly from side to side over the rectum and downward if the tumor is small enough to permit the finger to reach above it. Infected cysts may lose this physical characteristic because of inflammatory reaction about the cyst, and on palpation an inexplicable presacral mass is felt which defies preoperative diagnosis, making surgical biopsy necessary. In some chronically infected cysts with a sinus that inadequately drains the cyst fluctuation is readily detected. The importance of careful digital examination over the ventral surface of the sacrum cannot be too strongly emphasized, for small asymptomatic cysts are not detected in cursory rectal examination.

Anoscopic examination reveals normal structures in most cases. In some, however, a sinus might be seen to open in the posterior aspect of the anal canal (case 6). In patients with an infected cyst and associated para-anal sinus it is imperative to rule out the presence of a fistula-in-ano (case 4).

Although most cysts are in the presacral space above the levator ani muscles, one patient of ours had an hour-glass shaped cyst the lower portion of which bulged under the anal skin posteriorly and proximal portion extended above the levator muscles, being connected by a thinly constructed portion that traversed the anal sphincter and levator ani muscles (fig. 2, case 2). The tenseness of the cyst made eliciting fluctuation difficult.

Tenderness is absent unless the cyst is infected, in which case the degree of tenderness is in proportion to the stage and severity of the suppurative process.

Roentgenographic studies with sinograms made in anteroposterior and lateral positions are helpful in determining the size and location of the cyst and also in ruling out fistula-in-ano. The following technic is recommended. To a 30 cc. syringe a small rubber catheter or polyethylene tube is attached; the catheter is inserted into the sinus tract to inject lipiodol into the cyst. The catheter is allowed to remain in the sinus tract preventing escape of the oil while the roent-

FIG. 2. Globular protrusion of cyst under the skin in posterior anal canal (case 2)

genograms are being made. To outline the rectum, a radiopaque rectal tube is inserted into the rectum and the intestine is inflated. The rectal tube is not removed until completion of the roentgenograms, for it serves as an additional marker to enhance roentgenologic interpretation. A good rectal shadow is essential in ruling out roentgenographically communications with the rectum. If the tract connects with the rectum, one must rule out fistula-in-ano or a cyst that has ruptured into the rectum as well as to the external skin. Usually roentgenograms will demonstrate the cyst to be in the presacral space displacing the posterior rectal wall anteriorly (fig. 3 case 4). If barium is used to distend the rectum, roentgenograms taken in the lateral position will show a soft tissue mass in the presacral space displacing the rectum anteriorly. Epidermoid inclusion cysts do not cause bony changes in the sacrum.

Cytologic Examination. In one of our patients (case 4), in whom the sinus incompletely drained the cyst, cytologic studies aided in confirming the diagnosis. A small catheter was inserted into the cyst and the aspirated contents were reported by the pathologist to contain degenerated squamous epithelial cells.

DIFFERENTIAL DIAGNOSIS

Presacral epidermoid cysts must be differentiated from a number of other conditions. Abscesses originating in the posterosuperior anal space may dissect into the presacral space, and when one is associated with an anal sinus—incomplete fistula-in-ano—it cannot be differentiated from a small infected epidermoid cyst. Jackman and associates[3] stressed the importance of microscopic study for definitive diagnosis. Other presacral inflammatory masses require surgical biopsy section for final diagnosis.

Granulomatous tumefaction following injection of a 5 per cent solution of

FIG. 3. Sinogram illustrating cyst in presacral space (case 4)

phenol and mineral oil usually can be excluded by a history of injection therapy for internal hemorrhoids. At times surgical biopsy section also is necessary.

Teratomas most frequently are seen in the newborn female but may occur late in life. These neoplasms have a mixed cystic and solid consistency and usually are large. Most of them protrude outward from their sacrococcygeal attachment displacing the rectum and anus downward and anteriorly. Infrequently, they may grow upward retroperitoneally into the abdomen.

Chordomas are neoplasms of notochord origin, and roentgenograms will show an expansive osteolytic lesion of the sacrum. In their growth they protrude into the presacral space and are palpated in the midline as a firmly fixed, nontender tumor with a slightly lobulated surface of rubbery consistency. The average age of patients is 35 to 40 years. Pain and neurologic symptoms are prominent manifestations.

Meningoceles are palpated ventral to the sacrum lateral to the midline in the region of the sacral foramina. They are tense, cystic, fixed tumors with a smooth surface.

In patients with neurologic symptoms, such as weakness or numbness in the legs, sciatic pain, or rectal or urinary incontinence, one must consider the possibility of infiltrative neoplasms, or an epidermoid cyst that may be palpated in the presacral space but actually originates from the meninges, with the greater part of the cyst in the sacral canal (case 7). Other lesions which must be considered in differential diagnosis are ependymal cell glioma, chondromyosarcoma,

anterior spina bifida, neurofibroma, fibrosarcoma, osteomyelitis of the sacrum, giant cell tumor, Ewing tumor and tuberculosis.

TREATMENT

In addition to routine preoperative examination to evaluate surgical risk, the patient is placed on a low residue diet and sulfathaladine; 2 Gm. every 6 hours is given for five days. Thirty-six hours before operation a castor oil purgative is given followed by 2 Gm. of neomycin every six hours. The preceding night and three hours before operation saline enemas are given until the returns are clear.

Operative Procedure. In our opinion, extirpation of the larger epidermoid infected or noninfected cysts is best accomplished with relative technical ease through an extrarectal parasacrococcygeal route. If the cysts are small and intimately associated with the anal sphincter and levator ani muscles with minimal extension into the presacral space, we prefer an intra-anorectal approach, which was used in 2 of our patients (cases 2 and 6). Under low spinal anesthetic with the patient in the prone modified jack knife position the buttocks, anus, perineum and vagina are surgically prepared. The exposure is enhanced by adhesive strapping, which pulls the buttocks outward and downward. The index finger of the left hand is inserted into the rectum and with the thumb externally the cyst and surgical landmarks are identified. The incision begins inferiorly at the peripheral border of the external sphincter and terminates in the region of the fourth sacral vertebra just lateral to the midline paralleling the ligamentum anococcygeum, coccyx and sacrum. The incision is deepened through the skin, subcutaneous tissue, lower fibers of the gluteus maximus, levator ani and coccygeus muscles to enter into the presacral space. We have never found it necessary to remove the coccyx; however, if wider exposure is needed, the coccyx may be excised. During severance of the levator ani and coccygeus muscles the index finger again is inserted into the rectum to safeguard against injuring the rectum. When the presacral space is entered, the cyst is readily identified. It has a thin pseudocapsule of fibrous tissue. In noninfected cysts it is best first to establish the line of cleavage over the posterior and superor aspects of the cyst, and by means of sharp and blunt dissection the cyst is readily separated from the sacrum and coccyx, for there are no posterior attachments. The anterior aspect of the cyst is in intimate contact with the muscles of the rectum and necessitates sharp dissection. The most difficult part of the dissection is separation of the anterior inferior portion of the cyst wall from the anorectal musculature. The cyst was noted actually to penetrate into the muscles of the anorectum in 4 of our patients (cases 2, 4, 6, 8) and extended to the rectal mucosa in the patient in case 3. If the rectum inadvertently is entered, the rent must be closed; however, if the operator keeps his left index finger in the rectum during the dissection, this accident frequently can be prevented.

In infected cysts disruption of the normal cleavage plane by inflammatory changes increases the technical difficulties. To cure these patients the entire cyst wall must be completely extirpated. In patients with one or more sinuses

FIG. 4. Postoperative wound illustrating location of scar and primary healing (case 4)

extirpation must include the tracts as well, for many acquire an epithelial lining. Because of the thin epithelial wall and pseudocapsule, the cyst frequently is ruptured during dissection. Placing the finger in a ruptured cyst frequently will facilitate dissection. The fluid in an uninfected cyst will be gray or yellow, resembling purulent exudate with a viscid consistency. Although frequently odorless, at times it may be foul. Culture studies of our cases were sterile.

After complete excision of the cyst and hemostasis the wound is flushed clean with normal saline solution and closed primarily in layers with cotton sutures, leaving a rubber dam to drain in the presacral space. The wound generally heals by primary intention (fig. 4). If the coccyx is excised, difficulty is encountered in closing the wound, and a weakness and defect may develop postoperatively.

Postoperative Care. The indwelling catheter in the bladder is removed on the third postoperative day. Administration of sulfathaladine is continued for one week and of streptomycin and penicillin for three to four days. Early ambulation is encouraged to permit more adequate dependent drainage and descent of the rectum against the sacrum to obliterate the presacral space. A regular diet is given and the patient is advised to avoid constipation. Forty-eight hours after operation any fluid that might be present in the presacral space is expressed digitally and the drain is removed.

Other Therapeutic Measures. If the cyst cannot be removed, Jackman and associates[5] advocated application of radium. In patients with acute abscesses from infected cysts or in those with asymptomatic large cysts which may be interfering with progress of labor, simple drainage should be instituted. External drainage is best done just inferior to the tip of the coccyx and a little away from the midline rather than through the rectum. Drainage through the rectum may persist as an infected draining sinus,[6] delaying surgical extirpation.

PROGNOSIS

Complete excision of epidermoid cysts affords permanent cure. Incomplete removal results in recurrence or persistent suppuration. Patients with infected dermoid cysts complicated by perianal sinus who have submitted to numerous futile operations for fistula-in-ano frequently suffer irreparable damage to the anorectum with resulting anal incontinence. No cases of malignant changes have been reported.

REPORT OF CASES

Case 1. S. O., a white girl aged 11, was admitted to the Ochsner Foundation Hospital Sept. 3, 1953 for acute appendicitis with an appendiceal abscess. Routine examination revealed a firm, smooth tumor in the presacral area. It appeared to be fixed; was not tender and was approximately 3 cm. in diameter. Four weeks after emergency incision and drainage of the appendiceal abscess the patient was readmitted for routine appendectomy, after which the presacral cyst was removed through a parasacrococcygeal incision. The microscopic diagnosis was epidermoid inclusion cyst (fig. 5).

Case 2. O. R., a white man, aged 52 had no complaints but entered the Ochsner Clinic Dec. 17, 1953 for routine complete physical examination. Examination revealed a tense cystic mass bulging under the skin in the posterior midline of the anal canal (fig. 2). Bidigital examination disclosed an hour-glass shaped mass. The inferior part beneath the skin was 3.5 cm. in diameter; the upper part extended into the presacral space, and the constricted part traversed the external sphincter. The lower portion was movable; the upper part fixed. The cyst was so tense that it had a firm, rubbery consistency and was not tender.

On Dec. 20, 1954 under caudal anesthesia an intra-anorectal approach to the tumor was used. The tumor, after penetrating the fibromuscular termination of the longitudinal muscles of the rectum, extended upwards into the external sphincteric muscles to just above the levator ani muscles. The posterior hemorrhoids were excised and the wound was left opened. The microscopic diagnosis was epidermoid inclusion cyst (fig. 6).

Case 3. Mrs. L. C., a 21 year old white woman, was referred to the Ochsner Clinic for treatment of a presacral mass which was discovered during the progress of labor. Examination revealed a firm, egg shaped mass 7.5 by 5 cm. in size, with a smooth surface and cystic consistency. The mass, which was slightly movable from side to side and could be compressed downward, was fixed inferiorly to the posterior anorectal region. It was only slightly tender. On Dec. 22, 1953 under low spinal anesthesia the cyst was excised through a parasacrococcygeal incision. Anteriorly, the fixation extended through the external and internal sphincteric muscles to the rectal mucosa near the dentate line. The defect in the sphincteric muscles was repaired and the wound closed primarily. The microscopic diagnosis was epidermoid inclusion cyst (fig. 7).

Case 4. Mrs. C. S., a white woman, aged 28, was referred to the Ochsner Clinic on Feb. 11, 1954 after two unsuccessful operations elsewhere. The first procedure was through a vaginal approach and the second through a para-anal route.

On admission examination revealed a slightly tender, cystic mass, 5 by 9 cm. in size, in the presacral space just to the right of the midline, with a draining sinus about 4 cm. from the anus in the 2:30 o'clock position. The mass was fixed to the perirectal tissue. The sinus was about 12 cm. in depth and the probe was palpated just posterior to the rectal wall. Sinograms showed the cyst to be in the presacral space (fig. 3). Cytologic study of the cyst content revealed degenerated squamous epithelium.

On April 4, 1954 under spinal anesthesia through a parasacrococcygeal incision, the cyst as well as the sinus tracts to the vagina and para-anal area were excised. The cyst was intimately attached to the rectum and terminated at the anal canal extending through the external anal sphincter nearly to skin level. The wound, which was closed primarily with a drain in the presacral space, healed by primary intention (fig. 4). The microscopic diagnosis was epidermoid inclusion cyst with chronic inflammation (fig. 8).

FIG. 5

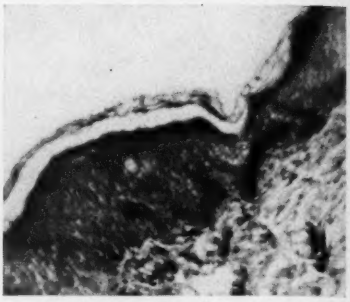

FIG. 6

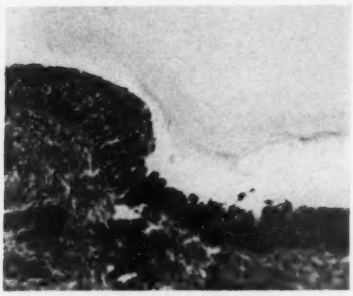

FIG. 7

FIG. 8

FIG. 9

FIGS. 5–9. Five different specimens obtained from cases 1, 2, 3, 4 and 7, H & E ×100. Note that each cyst is lined by stratified squamous epithelium with keratinization. The subepithelial tissue shows varying degrees of chronic inflammation.

Case 5. W. F. S., a white woman, aged 65, was admitted to the Ochsner Clinic in October 1954. Thirty years before, she had had a rectal operation because of a chronic draining sinus about the anus that was associated with soreness; the wound continued to drain for several months postoperatively before healing. Anal soreness and constipation had persisted but there was no recurrence of discharge. Six years before the present admission routine digital rectal examination elsewhere disclosed a cystic mass in the prescral space but the patient refused to submit to surgical extirpation. This examination revealed a cystic mass 5 by 6 cm.

in size. The upper extent of the mass was slightly mobile, whereas the lower portion was intimately fixed and seemingly attached to the posterior anorectal musculature. The patient again decided to defer surgical extirpation.

Case 6. E. Z., a white man, aged 35, was admitted to the Ochsner Foundation Hospital, May 28, 1948 with a history of recurrent attacks of acute pain and swelling in the anal region. Examination revealed a small presacral cyst connected to a draining anal sinus posteriorly in the midline near an anal crypt with hair protruding through the sinus. The abscess was treated by incision and drainage. An ischioanal abscess also was present. On May 19, 1950, the patient was readmitted to the Ochsner Foundation Hospital with identical findings as in 1948. After insertion of a probe through the anal sinus into the abscess cavity an incision was made over the probe to expose the abscess, dermoid cyst and sinus tract. The small dermoid cyst measuring 2 by 3 cm. in front of the coccyx was dissected out, the cavity was cauterized with phenol followed by alcohol, and the wound was marsupialized and packed open. When examined in February 1953, the wound had healed and the patient was continent. The microscopic diagnosis was unsatisfactory.

Case 7. A white boy aged 6, came to the Ochsner Clinic June 12, 1952, complaining chiefly of pain in the region of the coccyx when he sat down. He also experienced pain during each bowel movement. Palpation disclosed a mass over the posterior sacrococcygeal area. On rectal digital examination the coccyx could be felt to protrude posteriorly and tilt to the left at an acute angle. A firm flat, disc shaped, semifixed, and extremely tender mass, measuring 4 by 6 cm., could be felt in the presacral space. It seemed to connect with the posterior sacral mass.

On Dec. 19, 1952 a neurosurgical and proctologic surgical team explored the area through a parasacrococcygeal incision. The mass, a rather large, tense cyst ventral to the lower sacrum, was dissected from the presacral space. It was not attached to the rectum but communicated with the sacral canal. During dissection the sac ruptured and approximately 60 cc. of yellow turbid exudate escaped. The lower sacral canal was unroofed and the sac entered into the sacral canal for approximately 6 cm. However, no nerves were seen in the sac and no spinal fluid escaped. Because the exudate was thought to be pus, the sac was incompletely amputated and definitive surgery was deferred for fear of meningitis.

The patient's postoperative condition was good for a while but the mass recurred. The patient complained of pain over the mass in the sacral area, being more intense when he walked. Tenderness was acute and the patient had no control over his bladder. Neurosurgical exploration revealed a normal dural sac except for the lower end, where it terminated with the square end. A cyst was attached to the lower end of the dural sac and extended anteriorly to it. The cyst ruptured, permitting escape of about 1 ounce of yellow, thick fluid, which was known, from previous experience, not to be infectious. The sac, which occupied the dural canal, was dissected out almost intact. The dural sac tore during the procedure and was opened. The sacral roots appeared bilaterally. The lower end of the dural sac was extremely thick and the sacral roots were matted together with a lipoma. Spinal fluid drained through the wound for a while postoperatively but the wound healed spontaneously and the patient's condition improved satisfactorily. The microscopic diagnosis was epidermoid inclusion cyst (fig. 9).

Case 8. W. E. P., a white man, aged 31, was admitted to the Ochsner Foundation Hospital in April 1952 for treatment of a peptic ulcer. Routine rectal examination disclosed a cystic, nontender mass 2 by 1.5 cm. in size just above the anorectal ring in the presacral space. The mass could be depressed downward but was fixed inferiorly. On Jan. 24, 1954, approximately two years later, no change was noted in the mass and surgical excision was deferred.

SUMMARY

Presacral epithelial cystic tumors probably originate from embryonic remnants that occur during the development and disappearance of the neurenteric canal, proctodeal membrane and postanal gut. Diagnosis of the asymptomatic

tumor is made by careful evaluation of the presacral space during digital rectal examination. In patients with para-anal sinuses without clinical evidence of a fistula-in-ano the epithelial cyst must be ruled out. The most effective treatment is complete extirpation through a parasacrococcygeal incision, without excision of the coccyx in most cases. Eight personal cases are presented.

REFERENCES

1. Colbert, J.: Cited by Hundling, H. W.: Ventral tumors of sacrum, Surg., Gynec. & Obst. *38:* 518 (April) 1924.
2. Ewing, J.: Neoplastic Diseases, ed. 4, Philadelphia, W. B. Saunders Co., 1940, p. 1065.
3. Jackman, R. L., Clark, P. L., III, and Smith, N. D.: Retrorectal tumors, J.A.M.A. *145:* 956 (March) 1951.
4. Lahey, F. H., and Eckerson, E. B.: Presacral dermoids, Am. J. Surg. *23:* 30 (Jan.) 1934.
5. Melody, G. F.: Presacral epidermoid cysts in women, Am. J. Obst. & Gynec. *63:* 1119 (May) 1952.
6. Shorten, E. A., and Fuzy, P. J.: Presacral dermoid in young adult male, Ohio State M. J. *45:* 1069 (Nov.) 1949.

PRIMARY INTRATHORACIC NONPULMONARY TUMORS

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It generally is accepted that the most common intrathoracic tumor is bronchogenic carcinoma, and likewise, it is a tumor that is most resistant to present day therapy and most often leads to disastrous results. The nonpulmonary intrathoracic tumor offers the greatest challenge to diagnostic acumen and also leads to the most satisfying results in the therapy of thoracic neoplasms. It is the purpose of this paper to discuss some of the nonpulmonary neoplasms that are found in the chest. The material in this study consists of about 30 selected cases of patients who have come to operation in the past few years. Soft tissue tumors, metastatic tumors with extrathoracic origin, and mediastinal lymph node disease are not included in this study. Until the past 15 or 20 years, reports in the literature concerning the diagnosis and treatment of these tumors were relatively rare, but due to the extensive use of routine chest rentgenograms, the problem in diagnosis and treatment of these neoplasms has become very common in the field of chest diseases. The clinical picture presented by these tumors is so variable that discussion of the symptoms is impossible. There may be all of the classical symptoms and physical signs found in the field of chest pathology or there may be no clinical findings; the latter is the usual. Roentgenograms of the chest offer the most valuable diagnostic information and most frequently provide the only evidence of an intrathoracic neoplasm. It commonly is accepted that the only way a definite diagnosis can be made is by exploratory thoracotomy, and all patients with roentgenographic evidence of a thoracic neoplasm should be explored after other diagnostic studies have been completed.

A number of cases will be discussed in this paper to illustrate the various types of extrapulmonary tumors under discussion, and the following anatomic classification is outlined for purposes of clarity:

THORACIC CAGE

1. *Rib Tumors.* Primary tumors of the ribs are relatively uncommon. Chondroma and chondrosarcoma is the most common primary tumor. There are occasional cases of primary sarcoma and Ewing's tumor of the rib reported in the literature. A lipoma or fibroma, or intercostal neuroma may occur in the intercostal space and produce erosion of the adjacent rib.

Case 1. Fig. 1. This 29 year old Negro woman was admitted to the hospital with a history of pain in the right upper abdominal quadrant for a duration of two or three years. She had had a gallbladder roentgenologic study a few days prior to admission to the hospital and this study revealed a destructive lesion in the seventh rib on the right side. At operation

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FIG. 1. Case 1. Fibrosarcoma of rib

the tumor appeared to be grossly confined to the rib. It was completely resected with most of the seventh rib and the adjacent soft tissue. The patient made a satisfactory operative recovery and showed evidence of recurrence in a one year follow-up study. Pathologic diagnosis was *medullary fibrosarcoma of the rib*.

2. *Sternum.* It is presumed that any tumor that may be found in the flat bones of the skeletal system also can be found in the sternum. Primary tumors of the sternum are rare, and usually the only symptom is pain or palpation of a tumor in the sternal region. In differential diagnosis of such lesions, metastatic new growths and inflammatory lesions always must be considered.

Case 2. Fig. 2. This patient was a 51 year old white man who, on admission to the hospital, gave a history of pain in the anterior chest in the upper sternal area at intervals for about two years. He stated that he noticed a small nodule over the upper sternum about six months after onset of pain. Roentgenologic studies showed a destructive process involving almost the entire manubrium. At operation the entire manubrium and the upper portion of the body of the sternum and the adjacent portions of the ribs were resected. The pathologic diagnosis was *reticulum cell sarcoma of the sternum*. Follow-up examination one year later showed no evidence of recurrence and the ptient appeared to be in good condition.

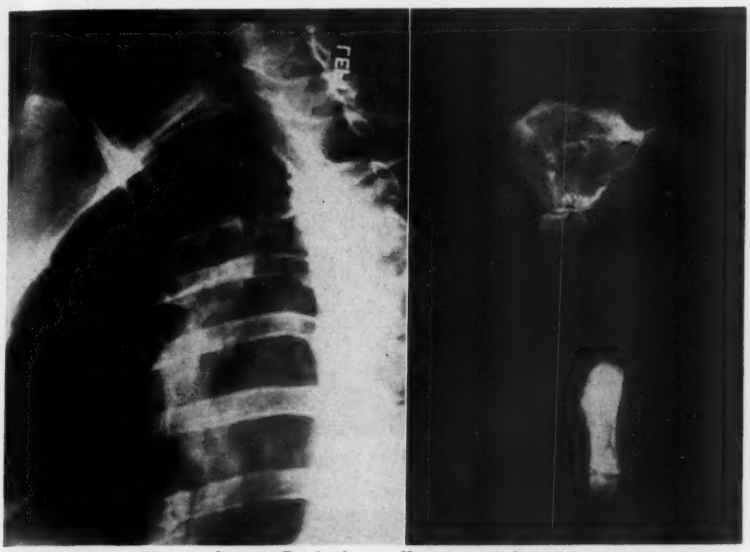

FIG. 2. Case 2. Reticulum cell sarcoma of sternum

PLEURA

Primary cysts of the parietal pleura are of rare occurrence. These cysts gradually may increase in size and present the characteristics of a benign tumor. Most observers accept the mesothelioma as the only primary tumor of the pleura. This tumor may occur either in a diffuse form or as a solitary or localized tumor. The diffuse type, commonly referred to as an endothelioma in the literature, usually appears as multiple nodules or elevations of both visceral and parietal pleura with a marked increase in pleura thickness associated with a sero-sanguineous effusion, and an early invasion of the lung, chest wall and diaphragm. The localized mesothelioma usually is circumscribed and may grow to an enormous size but rarely metastasizes. This localized tumor tends to grow slowly and runs a benign course and readily can be surgically excised in most cases.

Case 3. Fig. 3. This 54 year old white woman was admitted to the hospital with a chief complaint of general fatigue and weight loss. Roentgenologic studies of the chest demonstrated a large ovoid mass containing a considerable number of irregular areas of calcification and occupies almost the entire right thoracic cavity. It was found at operation that the large tumor almost completely filled the right chest cavity and produced collapse of almost the entire right lung. The tumor had a gross weight of 1,225 Gm. with a 35 cm. circumference. The pathologic diagnosis was *mesothelioma of the pleura*. Examination of the patient five years later showed no evidence of recurrence and the patient appeared to be clinically well.

ANTERIOR MEDIASTINUM

1. *Lymphomas.* Tumors of the lymphoma group comprise the most common neoplasm in the anterior mediastinum and always must be considered in a dif-

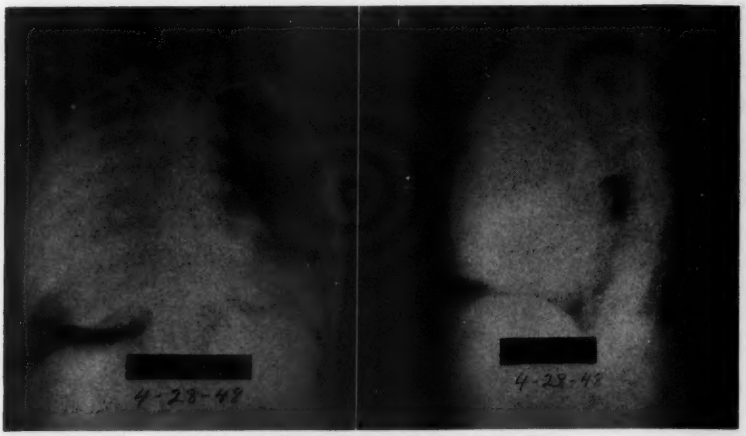

FIG. 3. Case 3. Mesothelioma of pleura

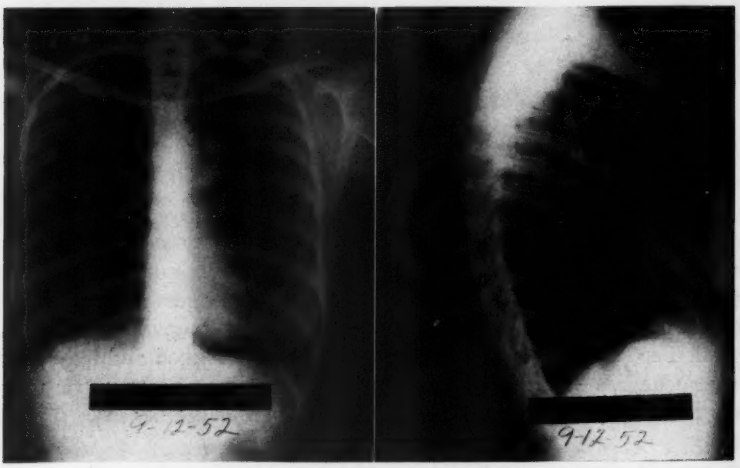

FIG. 4. Case 4. Dermoid cyst of mediastinum

ferential diagnosis, but in view of the fact that such tumors are excluded in this study, further discussion will be omitted[1].

2. *Teratoid and Dermoid Tumors.* These are slow growing tumors which may be solid or cystic; usually assume a round or oval shape and may reach an enormous size and not be clinically or radiographically evident until adulthood. They are asymptomatic until pressure phenomena from adjacent organs become apparent. All of these tumors should be removed, as they may develop malignant characteristics, or may result in serious complications due to the size of the tumor.

Case 4. Fig. 4. This 40 year old white woman was admitted to the hospital because of findings of a tumor mass on routine roentgenogram of the chest. At operation an irregular encapsulated mass about 5 to 6 cm. in diameter was found in the anterior mediastinum. The mass was removed through a left thoracotomy incision without difficulty. The patient made an uneventful recovery. The pathologic diagnosis was *dermoid cyst*.

3. *Thymus.* There is considerable confusion regarding classification of tumors of the thymus. Hyperplasia of the thymus, although not a true tumor, may produce increase in size to the extent that severe pressure symptoms may result. Generally, thymomas are classified as benign and malignant, but in either case surgical excision should be attempted as no definite diagnosis as a rule can be made otherwise. Cystic disease of the thymus has been reported. Bradford and associates[2] recorded a case of a successful excision of polycystic disease of the thymus gland in 1947.

Case 5. Fig. 5. This 45 year old white man was admitted to the hospital with a history of generalized weakness and weight loss for about three months. Roentgenologic studies of the chest showed a well defined mass projecting to the right of the midline. At operation a large firm tumor was visualized in the anterior mediastinum. This well encapsulated tumor was excised without difficulty. Follow-up examination two years later showed the patient to be in good condition with no evidence of recurrence. There was some difference of opinion as to the pathologic diagnosis but the final diagnosis was a *benign thymoma*.

Case 6. Fig. 6. This 7 months old male infant had spent most of his short life in the hospital because of obstructive dyspnea. Numerous roentgenologic studies, beginning with the second day of life, had demonstrated a marked widening of the superior mediastinum. Two courses of radiation therapy had been given in the first 2 months of life for what was presumed to be an enlarged thymus gland. On more recent roentgenograms the mass appeared to be largely in the superior mediastinum and the right thorax. A large tumor was removed from the superior mediastinum, which obviously was the thymus gland. The patient has made a satisfactory recovery and six months follow-up examination showed no evidence

FIG. 5. Case 5. Benign thymoma

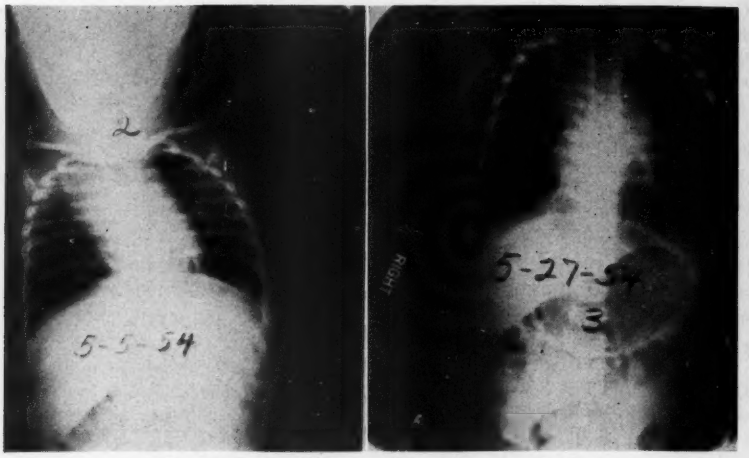

FIG. 6. Case 6. Hypertrophy of thymus gland

of recurrence and the obstructive dyspnea has been relieved. The pathologic diagnosis was *hypertrophy of the thymus gland*. The total weight of the specimen was 46 Gm.

4. *Heart and Pericardium.* A. *Pleuropericardial Cyst.* These lesions nearly always are asymptomatic and found on routine roentgenologic examinations of the chest. I have personally observed only 1 case in which symptoms were produced and these symptoms were referrable to the size of the cysts which filled almost the entire lower half of the right thorax. These cysts probably are of little clinical significance per se, but it is almost impossible to differentiate such new growths from other neoplasms that occur in the chest. Thoracotomy thus is always adviseable[4].

FIG. 7. Case 7. Pleuropericardial cyst

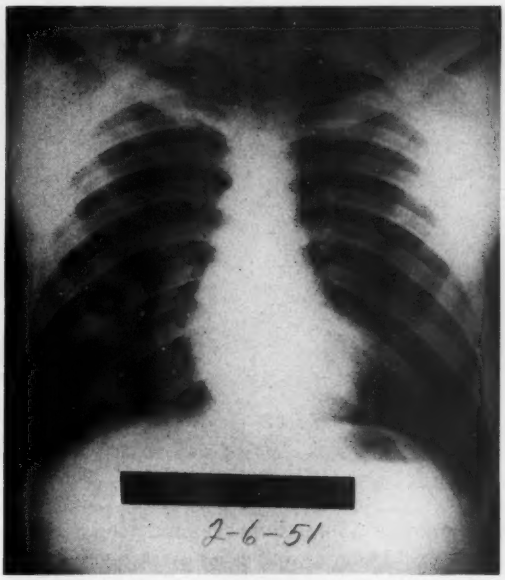

FIG. 8. Case 8. Pericardial diverticulum involved with sarcoid infiltration

Case 7. Fig. 7. This 50 year old Negro man was admitted to the hospital because of a routine roentgenologic finding of a mass in the right lower chest. Exploration revealed a large cystic mass in the right cardiophrenic angle which was resected without difficulty. The cyst contained clear fluid. The pathologic report was *simple cyst*.

B. *Pericardial Diverticulum*. Occasionally, one may see a pericardial diverticulum or cyst which appears unrelated to the pleuropericardial cyst just described. They may be congenital in origin or may result from an associated inflammatory process.

Case 8. Fig. 8. This 28 year old white man was admitted to the hospital because of findings of mediastinal adenopathy on routine roentgenologic studies of the chest. There also was noted a circumscribed density adjacent to the left border of the heart. A left thoracotomy was done and a mediastinal node was removed for biopsy studies. A cyst 5 by 4 by 2.5 cm. in size was found along the border of the left pericardium. This cyst communicated with the pericardial sac by a small opening. It was removed without difficulty. The pathologic diagnosis was *pericardial diverticulum involved with sarcoid infiltration in the wall*.

POSTERIOR MEDIASTINUM

The most common tumor located in the posterior mediastinum is of neurogenic origin. These neurogenic tumors probably are the most common primary mediastinal tumors with the exception of carcinoma of the esophagus. Malignant tumors of the esophagus are not to be considered in this study. Neurogenic tumors arise from spinal, intercostal and sympathetic nerves and ganglia which explains the usual location near the spine. These tumors occasionally originate

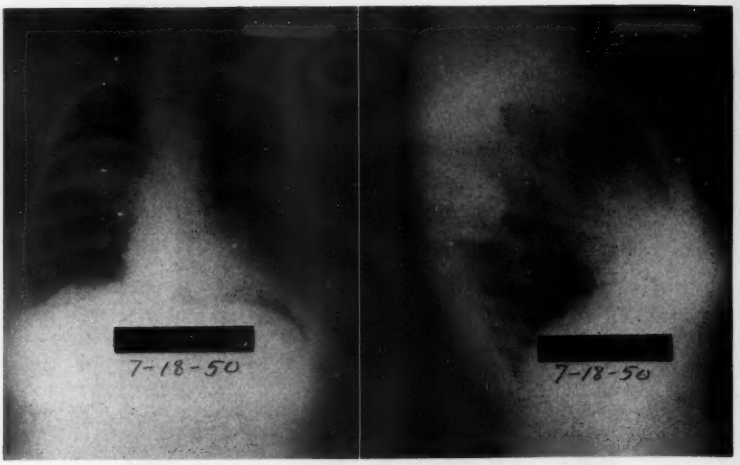

FIG. 9. Case 9. Neurofibroma

from within the intervertebral foramina thus producing a dumbbell type tumor resulting in an intraspinal lesion as well as an extraspinal lesion. The neurinoma always should be removed. Although it is usually benign, it may undergo malignant changes. Many other types of tumors may occur in the posterior mediastinum such as lipomas, fibromas and neuroblastomas[3].

1. *Neurinoma.* Case 9. Fig. 9. This 61 year old white woman first was admitted to the hospital because of pain in the right lower chest. Roentgenologic studies of the chest had shown a large mass in the right posterior chest. At operation this well encapsulated tumor was removed without difficulty. The pathologic diagnosis was *neurinoma.* About four years later this patient developed severe pain in the posterior chest and weakness in both lower

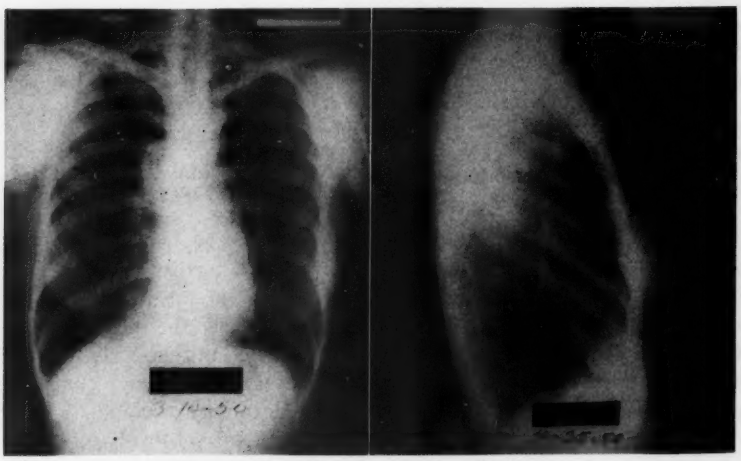

FIG. 10. Case 10. Fibroma of mediastinum

extremities. Neurologic examination showed evidence of spinal cord lesion. At exploration an extensive tumor was found apparently at or near the site of the original operation, with bone destruction and spinal cord compression. The pathologic diagnosis was *round cell sarcoma*. It is believed that this represents a recurrence of the tumor at the original site with the original tumor undergoing malignant changes. It is interesting to note that the pathologists stated at the original study that the neurinoma was of borderline malignancy

2. *Fibroma.* Pure fibromas of the mediastinum relatively are rare. In 1941, Blades reported from the World's Literature[5] 32 cases of intrathoracic fibromas.

Case 10. Fig. 10. This 40 year old white woman was admitted to the hospital with no specific complaints. A routine chest roentgenogram revealed a tumor in the mediastinum which projected into the right thorax. A well encapsulated tumor was removed from the posterior mediastinum. Follow-up studies four years later showed no evidence of recurrence. The pathologic diagnosis was *fibroma*.

Case 11. Fig. 11. This 51 year old white woman was admitted to the hospital because of progressive dyspnea. Roentgenograms of the chest showed a large ovoid mass filling the entire lower two-thirds of the left thorax. At operation a well encapsulated tumor was removed from the left thorax. The lung was almost completely compressed by the tumor mass. Examination four years after operation showed the patient to be in good condition with no evidence of recurrence. Pathologic studies showed a large ovoid tumor which weighed 1,200 Gm. and measured 14 by 11 cm. with 12 cm. in its greatest diameter. The pathologic diagnosis was *liponeurogenic sarcoma*.

3. *Esophagus.* Tumors of the esophagus probably are the most common extrapulmonary neoplasm in the thorax. Occasionally one finds lesions in the mediastinum on roentgenologic studies which may represent an enterogenous cyst of

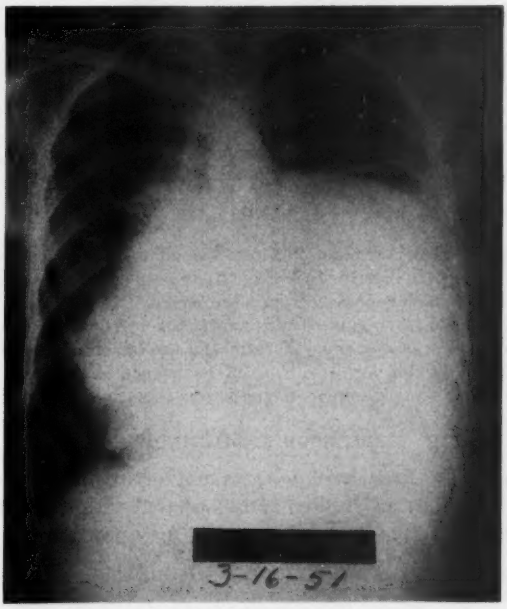

FIG. 11. Case 11. Liponeurogenic sarcoma

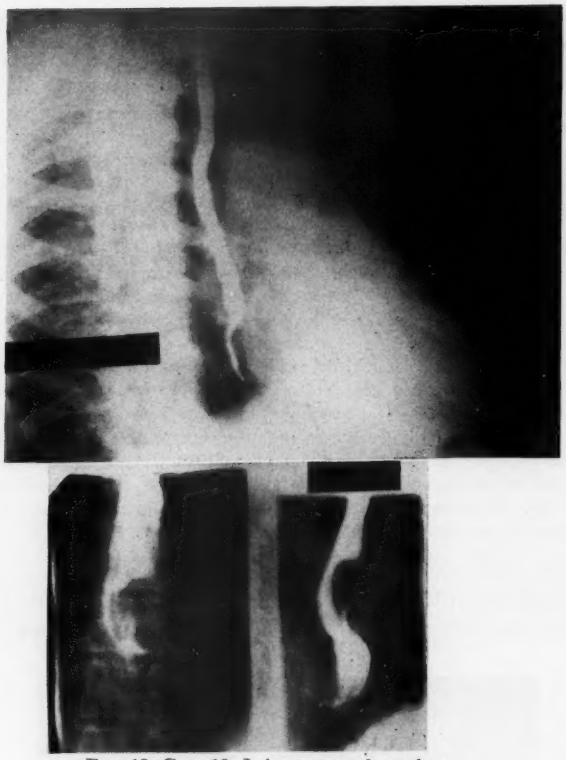

FIG. 12. Case 12. Leiomyoma of esophagus

the esophagus or a solid tumor of the esophageal wall. Sweet recently reported a series of 21 benign tumors of the esophagus, most of which were extralumenal tumors.

Case 12. Fig. 12. This 45 year old white man was admitted to the hospital because of hypertensive cardiovascular disease. In routine fluoroscopic studies a small lesion in the posterior mediastinum which encroached upon the lumen of the esophagus was found. At operation a small tumor 3 by 5 cm. in size was found in the wall of the esophagus in the lower third. This tumor was excised without difficulty and the lumen of the esophagus was not entered. The patient has shown no evidence of recurrence on examination—about nine months after operation. The pathologic diagnosis was *leiomyoma of the esophagus*.

SUPERIOR MEDIASTINUM

1. *Bronchogenic Cyst.* Bronchogenic cysts may occur in any part of the mediastinum but usually they are located and associated with major bronchi. These cysts are practically always asymptomatic but may produce symptoms by reason of pressure or secondary infection.

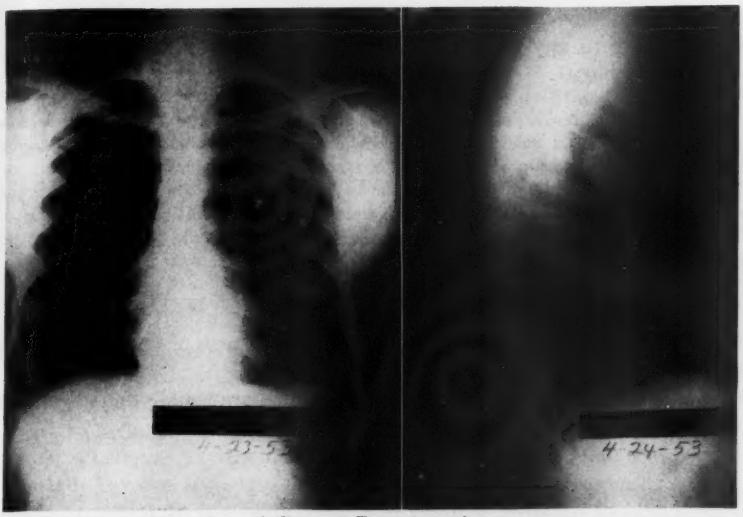

FIG. 13. Case 13. Bronchogenic cyst

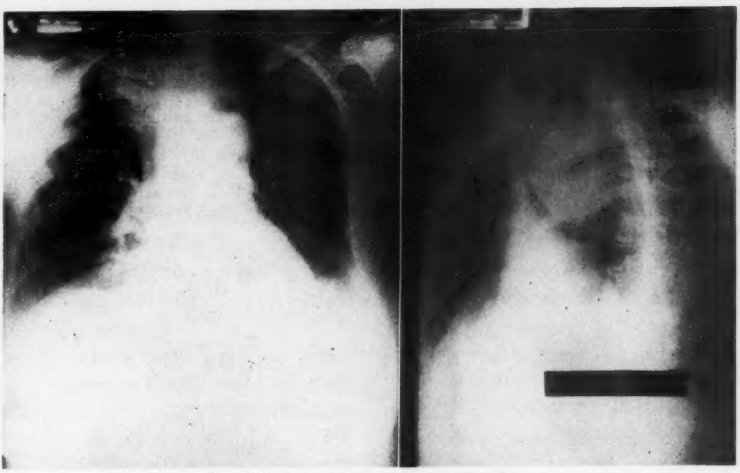

FIG. 14. Case 14. Retrosternal goiter

Case 13. Fig. 13. This 23 year old man was admitted to the hospital because of a mass being found on routine roentgenologic examination of the chest. At operation a simple cyst containing serous fluid was found in the superior left mediastinum. It was removed without difficulty. The pathologic diagnosis was *bronchogenic cyst*.

2. *Retrosternal Thyroid.* Intrathoracic goiter relatively is rare. The diagnosis of the intrathoracic thyroid usually is not difficult and nearly always is demon-

strated by roentgenologic studies. Many of these lesions are asymptomatic but if they develop to any size, usually they produce pressure symptoms on the trachea or esophagus.

Case 14. Fig. 14. This 54 year old white woman was admitted to the hospital because of progressive dyspnea and wheeze. Roentgenologic studies of the chest revealed a large mass in the superior mediastinum with evidence of tracheal compression. There was a history of a thyroidectomy done about 25 years prior to this admission. On physical examination there was no evidence of any mass in the thyroid area. At exploration the large tumor was removed with considerable difficulty from the superior mediastinum. The pathologic diagnosis was a *simple goiter*.

SUMMARY AND CONCLUSIONS

A general discussion of primary nonpulmonary tumors of the thorax has been presented.

It is believed that the majority of these tumors are usually found on routine roentgenologic studies of the chest.

The correct diagnosis can be rarely established without surgical exploration. Even though most of these tumors are benign in type, it is believed that all such tumors should be removed in every case, if feasible. Although most of these tumors are benign, the majority of them will produce serious complications or develop malignant changes, if adequate treatment is not provided.

REFERENCES

1. Bradford, M. L., Mahon, H. W., and Crow, J. B.: Mediastinal cysts and tumors, Surg., Gynec. & Obst. *85:* 467 (Oct.) 1947.
2. Brindley, G. V., Jr., and Henderson, J. A.: Mediastinal tumors, Am. Surgeon *20:* 260 (March) 1954.
3. Fouche, J. W.: Benign fibroma of mediastinum, Dis. Chest *19:* 589 (May) 1951.
4. Lippert, K. M., Petozky, H., and Furman, I. K.: Clinical significance of pleuro-pericardinal cyst, A. M. A. Arch. Int. Med. *88:* 378 (Sept.) 1951.
5. Sabiston, D. C., Jr., and Scott, H. W., Jr.: Primary neoplasms and cysts of mediastinum, Ann. Surg. *136:* 777 (Nov.) 1952.

THE SURGICAL KNEE

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The surgery of trauma has become a definite specialty and the surgical knee has been closely associated with the earliest beginnings of this phase of surgery and has been intimately connected with its subsequent growth. The senior author (J. J. M.) presented a paper on the "Surgical Knee" at the first meeting of the Southeastern Surgical Congress in Atlanta 25 years ago. This essay summarized the results and gave the conclusions of a consecutive series of 163 knee joint arthrotomies done from Feb. 9, 1919 to 1930. Two previous papers on this subject were presented and published—one in March 1926 and the other in May 1928. Since 1930 a few additional presentations on the same subject of the surgical knee have been given by the senior author.

Dr. Louis P. Brady, one of the associates of the junior author (E. L. J.) has performed a splendid task of looking up and summarizing 145 consecutive knee joint arthrotomies that he (E. L. J.) and his associates have done since the latter part of 1946 through 1954.

The purpose of this paper is to compare these two series of cases and also to state the advances in knee joint surgery that have ensued since 1930 to the present time. Both series of cases excluded fresh fractures of the knee joint area, simple lacerations or foreign body penetrations. The more recent series had a greater number of patellectomy cases and a few more Baker's cysts but did not contain as many semilunar cartilage excisions (tables I, II).

Knowledge of anatomy and physiology of the knee joint remains unchanged and there is nothing to add to the discussion of these topics as brought out in the earlier paper in 1930. Antibiotics and hydrocortone acetate have been of great help in recent years in preventing infections in the knee joint and tending to curtail adhesions. However, in the earlier series of 163 patients who were operated upon by the senior surgeon (J. J. M.) there were no serious infections of any of the joints. There were three infected hematomas which cleared up well without any serious sequelae. Likewise, in the latter series of the junior author (E. L. J.) there were no intra-articular infections and only a very few superficial wound abscesses with no serious after effects. Hydrocortone acetate is of definite aid, especially in preventing adhesions in the postoperative knee and in treating the arthritides of the knee joint.

The senior surgeon (J. J. M.) has for many years stressed the analogy of the knee joint to the peritoneal cavity and in his later years has observed and often mentioned the similarity of various aspects of the torn semilunar meniscus and the ruptured intervertebral disc.

Presented during the Atlanta assembly of The Southeastern Surgical Congress, Feb. 21-24, 1955.

TABLE I

Summation of the 145 cases from 1946 through 1954—Analysis of cases of meniscectomy

Total meniscus cases 95 Sex: Male 75
Total with follow-up 82 Female 20

Ages—years

	1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–up
Number	none	18	18	18	18	11	6	6
Per cent	0	19	19	19	19	10.5	6.3	6.3

Meniscus

	Medial Semilunar	Lateral Semilunar	Bilateral	Football	With Locking	Without Locking
With Osteochondritis Dissecans	33	5	10	17	27	68
Without Osteochondritis Dissecans	28	10	9	—	—	—

Symptoms—Duration (months)

0–3	4–6	7–9	10–12	13–18	18–2 yrs.	Over 2 yrs.
36	21	5	6	2	3	17

Main Symptom

Pain	Pain & Swelling	Locking	Instability	Swelling Alone
26	39	19	9	1

Surgery

With Tourniquet	Without Tourniquet	Suprapatella Pouch	Fat Pad	Osteochondritis dissecans	Partial Patellectomy	Medial Semilunar	Lateral Semilunar	Medial and Lateral
53	35	17	45	47	4	61	15	19

Incision

1–2″	3–4″	5–6″	Paramedian	
			(7–8″)	9–10″)
2	35	17	31	4

Results

Good	Fair	Poor	3 mos.	6 mos.	9 mos.	1 yr.+	Compensation		
							G	F	P
47	27	8	27	15	5	37	6	12	5

Good—Full range of motion, no pain, no permanent partial disability.

Fair—180° extension, 90° flexion, slight pain, not over 10 per cent permanent partial disability.

Poor—Less than full extension, pain, weakness, instability, etc.

TABLE II

Summation of the 145 cases from 1946 through 1954—Analysis of cases other than meniscectomy

Case	Total	Excellent	Good	Fair	Poor	Male	Female	No Follow-Up
Baker's Cyst	15		10		1	10	5	4
Loose Body	3		2	1		2	1	
Fusion	2		2			1	1	
HeyGroves Repair Tear Anterior Cruciate	2			2			2	
Removal of Bursa Bursitis	2		2			2		
Gout	2					2		2
Quadricepsplasty	1		1				1	
Arthroplasty	3		1	1			3	1
Patellectomy	20	8	7	5		8	12	

Excellent—Full extension, flexion within 20° of other knee, no pain.

Good—Full extension, flexion to right angle, only pain with weather change.

Fair—Some limitation in extension, flexion to 110°, pain with weather change and excessive use of leg.

Poor—More limited motion and pain, pain more pronounced and unable to carry on regular duties.

DIAGNOSIS

The diagnosis of internal derangements of the knee joint has not changed an iota in the last 25 years even though several attempts have been made to push to the forefront the use of air or other gases in making airograms of the knee joint. We could never see the reason for using this airography and it is not generally employed at this time. A careful history, plus a thorough physical examination and good roentgenograms (occasionally using obliques, tunnel views, sagittal or tangential positions) are all of the necessary criteria for making a good, accurate diagnosis.

TREATMENT

In the realm of operative technic, little has been gained in this interim except for the extension of the suprapatellar pouch up into the thigh muscle planes as originated by Chandler. This has greatly hastened the absorption of joint fluids in the postoperative period and has markedly reduced the number of cases where aspiration has been necessary.

The senior essayist has used the *touch me not* technic of Lane in all of his knee joint operations including those done in his initial 163 cases. In the latter series of 145 done by the junior essayist this technic was not used although a minimum of finger palpation in the exposed joint has always been stressed. The Lane technic is most difficult to use in smaller hospitals especially where the necessary house staff is not available. The criteria of meticulous care and minimal trauma to the structures in and about the knee always have been and still are of paramount importance.

The tourniquet was used routinely by the senior author and in a vast majority of the junior author's cases. There have been advances in the tourniquets and

the old rubber band or tube has been replaced by the pneumatic or aerosol types. In certain elderly patients with vascular diseases in the lower extremities a tourniquet should not be used. An arthrotomy of the knee joint may be done and done well without using a tourniquet but the operation takes longer.

The senior surgeon has for many years been an exponent of the paramedian (mediolateral, parapatellar or patellar-margin) as opposed to the shorter medial and lateral incisions of various shapes, lengths, positions and names. Vigorous opposition to the longer scar of the paramedian incision has led to its condemnation by the insurance companies in various cities and states which has resulted in its abandonment by many surgeons. However, neither of the authors has personally had any such trouble with the insurance companies. We both believe that in a young female with a recent injury, when all signs and symptoms point to a single meniscus tear, a shorter vertical, oblique or transverse incision may be made on the side of the injury. However, in recurrent cases when there is a question of bilateral altered anatomy or evidence of pathology, or in the middle age or elderly groups the longer paramedian incision should be employed. This incision gives complete exposure to the entire median, anterior and lateral knee joint compartments, and does not in any way impede the postoperative quadriceps exercising or early motion of the knee joint, as no muscle fibers are transversely severed. Just as the small McBurney incision in the abdomen has given ground to the longer lower right rectus muscle-splitting incision, so the small stab wound in the knee joint has been to a great extent replaced by longer incisions which give much better exposure.

There are several schools of thought as regards how much of a torn meniscus should be removed, and how it should be done. Fairly recently, the Campbell Clinic group advised removing only the loose part of the torn cartilage without molesting the untorn section. We believe in removing as much of a torn cartilage as possible. The cartilage is freed from its tibial attachment from the anterior to the posterior horn and then is dislocated into the center of the joint where the posterior horn is cut using either knife or scissors. Recently Duncan McKeever of Houston, has portrayed an ingenious method of leaving the anterior horn attached until the entire cartilage is pulled into the midline of the joint by traction on the midportion, which creates a surgical bucket-handle affair. Then the posterior horn is severed and last the anterior horn. This is a new idea and worthy of trial.

At times, loose bodies or a badly mangled posterior horn demands entry into the posterior compartment by going in just behind the collateral ligament. This can be done through a separate skin incision, or by retracting the original skin incision, if it is long enough.

For Baker's cysts and certain other conditions encountered in the posterior part of the knee joint, the accepted incision is of the letter S shape, or a semi-elliptical one may be used. This is some improvement over the formerly employed vertical or transverse incisions. There has been nothing new in regard to the shape or position of the portal of entry into the posterior compartment of the knee joint.

As regards the closure, the senior author used four layers although the junior

author has routinely used only three, omitting closure of the synovia. Both of us advocate chromic catgut for the fascia and the muscle layers, plain catgut for the subcutaneous tissues and silk or cotton for the skin. The senior essayist, while going to Europe in the first World War on a troop ship, ran out of surgical silk and had to use Crookes No. 36 red cotton thread. This proved to be adequate and subsequently was used almost routinely for skin closures. Neither of us has used, to any great extent, nylon or stainless steel. The postoperative cotton muff type of dressing is used and has been used and praised by the senior essayist for many years. In the early days most surgeons were using plaster casts which were left on for from one to two weeks after the operation. The junior essayist has been an enthusiastic follower of this practice and has employed it routinely since coming to Florida in 1936. The cotton muff dressing is held in place generally with two ace bandages which begin at the base of the toes and extend up to the groin. This dressing permits early active motion of the knee joint but gives definite stability and adequate immobilization for the knee when the patient is asleep.

A part of knee joint surgery which was considered most radical in the early days but which is in much more common use now, is the more or less complete synovectomy of the knee joint with removal of any bony spurs that impede motion or function of the joint combined with partial or complete patellectomy. The senior author was one of the first to stress the importance of removing a thickened, reddened or brownish synovial lining which he stated was a definite source of chronic infection or at least inflammation in the joint. Even though the bacteriologic tests were inconclusive, a great number of these patients were definitely improved by the removal of this abnormal boggy tissue. As we all know, a new synovial lining will be regenerated within a few weeks and for the most part will be a much more normal structure than the one removed. The junior author has carried on with this teaching and has found it a most helpful part of knee joint surgery. The use of antibiotics and hydrocortone acetate has greatly aided in the good results from this procedure. In recent years the use of blood and hemostatic medications has definitely been of aid in knee joint surgery. This especially is true in the old arthritic knees where a large quantity of synovial lining and more or less bone has been removed. There generally is considerable postoperative oozing for several days and blood transfusions not only replace this loss but greatly reduce the shock from the operative procedure.

In the partial removal of the patella there is one advance which has to do with the method of covering the under raw surface of the osteotomized patella by the upward swung patellar fat pad which is left attached to the distal pole of the patella. This pad is sutured around the proximal end and sides of the patella so as to completely cover the raw bony surface. This has been much better than using fascia and has allowed much earlier motion of the knee joint and use of the quadriceps than is possible when a complete patellectomy has been done with or without fascial transplant or suture.

As we all know, there is a definite need for early postoperative motion of the knee joint and use of the quadriceps muscle in the rehabilitation of the lower

extremity. With a long standing internal derangement of the knee joint, where there is much atrophy and weakness of the thigh muscles, a carefully carried out plan of strengthening exercises for this muscle should be followed preoperatively for several days or weeks in order that the quadriceps muscle may be just as strong as possible at the time of the operation. This aids greatly in the postoperative return to power of the muscle and the use of the joint. The senior essayist stressed this treatment from the early nineteen hundred and twenties and it still is used today. His patients were made ambulatory a day or two after operation and pushed a chair around the room in place of using crutches. In the later series of 145 cases the junior author has advocated the same principle but has used walkers and crutches more than chairs as they can be carried about easier by car. All supports of any type are eliminated as soon as possible.

The use of hydrocortone acetate in the joint has greatly lessened the need for closed manipulation of the stiff joint in the months following the operation, but still this at times has to be done. In this respect Trilene has proved to be a great boon to the manipulation of the stiffened knee in the office. What formerly was a hospital procedure, can now usually be done with safety in the office and repeated as often as necessary.

DISCUSSION

The following axioms and quotations used first by the senior essayist still are good guideposts:

"No knee is stronger than its own quadriceps."

"Work the quadriceps if you want an earlier and most lasting result."

"The rule of two. Have the patient move the knee joint twice every two hours for the next two days from 8.00 A.M. to 8.00 P.M. beginning two hours after recovery from the anesthetic."

"The S.O.L. treatment." S—soaking the knee in hot soapsuds solution or compresses for 10 minutes. O—a 10 minute rubbing or massage of the joint with camphorated oil. L—a 10 minute heating of the joint with a 60 or 75 watt lamp bulb held about 12 to 14 inches away from the knee.

"The man who wields the knife still is the all important factor despite the new drugs."

The 2 patients with gouty arthritis of the knee joint did not have any signs or symptoms of the condition anywhere else in the body and were evaluated as having surgical knee joints before the operations were done. Dr. DeWitt Stanford, one of the junior author's associates, operated upon both of these patients and will describe them in detail in a forthcoming article. It might be said in passing, however, that one presented all of the findings of a tumor in the suprapatellar pouch and patella itself, and the other one had a definite clearcut history of locking without adequate trauma. The first patient died of cardiac complications three weeks postoperatively, but the other patient made a splendid recovery although he is under medical care at this time for his gout.

Another patient worthy of mention is one in whom the junior author substituted part of a patella for a badly disrupted tibial condyle in a painful disabling

knee joint. This transplanted patellar fragment grew to the tibia, thereby taking over the function of the destroyed tibial condyle in a most satisfactory fashion. The patient is now 12 months postoperative and has a painless, almost normal knee. This method was first described in The Journal of Bone and Joint Surgery recently.

SUMMARY OF OUR 145 CASE SERIES

Meniscus injuries were found in patients between the ages of 10 and 80 with equal percentages in each of the decades from ages 11 through 50 years.

Football injuries were not as common a cause for meniscus derangements as has been reported in other series.

The most commonly occurring complication of the ruptured semilunar cartilage was osteochondritis dissecans. There was a total of 48 patients in this series who had osteochondritis dissecans associated with ruptured cartilage as compared to the 47 who did not. Sixty-one cases involved the medial semilunar cartilage; 15 cases involved the lateral semilunar cartilage; and 19 cases were bilateral. Seventeen of these cases were due to injuries sustained in patients in the age group from 11 to 20 years from playing football. In both the earlier and later series locking was not a very frequent finding. Twenty-seven of our cases had locking; 68 of them gave no history of locking. Thirty-six of our patients had symptoms for less than three months; 21 for less than six; 5 for less than nine; 6 for less than one year; and 17 had symptoms for over two years, the longest being 10. The commonest presenting complaint was pain and swelling and only 1 case had swelling without locking, pain or instability. Our patients were predominantly male, there being 75 males and 20 females.

There were 20 complete patellectomies in this series, several of which were in the 60 and 70 year age groups. These latter were operated upon for arthritis and osteochrondritis dissecans and the results have been uniformly good. In the younger age patients most of the results were excellent. They can kneel and put some weight on their knees, although, of course, that is cautioned against as a regular practice. When these patients have to kneel in order to do their work we always have them use a thick sponge rubber pad.

SUMMARY

In the senior author's series of 163 cases presented to this surgical society 25 years ago, and in the junior author's series of 145 cases between the years of 1946 and 1954 there are many points of similarity as regards cause, treatment and result. With the exception of a few minor details very little has been added to the surgical technic or treatment of the surgical knee except in the realm of antibiotics, hydrocortone acetate, blood transfusions and hemostasis.

EMERGENCY COLON RESECTION WITH PRIMARY OPEN ANASTOMOSIS WITHOUT PREOPERATIVE ANTIBIOTIC THERAPY

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In the past decade, there has been made little progress in the surgical management of the acutely obstructed colon. To say that we are satisfied with the surprisingly high postoperative mortality rate, and the multistage procedures required in the prevailing management of these cases would be a gross misstatement of the truth. It does seem, however, that we have not accepted the challenge given to us by Owen Wangensteen in an address before the National Gastroenterological Association at Boston in 1949 when he stated, "Were it not for the sea of unruly gut which confronts the surgeon when he operates, most of us would capitulate willingly and whole heartedly to the thesis that every patient should be operated upon the minute he can be gotten ready for operation". It is our purpose to present a method of dealing with unruly intestine that confronts the surgeon in acute intestinal obstruction. Our discussion will be confined to operation upon patients who are acutely obstructed, primarily in the large bowel, and which because of their acute obstructive process, have had no previous antibiotic bowel preparation prior to operation.

With incomplete obstruction on the other hand, delay must be *strongly* advised. The thorough cleansing of the bowel, the administration of oral antibiotics, and sufficient time in which to study and correct the blood chemistry, fluid and electrolyte balance, leaves little to be desired in the conduct of adequate preparation.

With the judicious use of the Levine tube and siphonage introduced by Wangensteen[10] in the early thirties, along with the aspirating device presented before this assembly in March 1953 by Gamble[4] and his associates on small bowel obstruction, fortified with the experimental work of Poth[8] on bowel healing and his later study and recommendations on the use of neomycin as a superior intestinal antiseptic in 1950, we were stimulated to seek a more simple approach to the surgical management of acute colon obstruction.

PREVALENCE

The prevalence of acute obstruction of the colon in the large clinics is by virtue of its patient source low ranging from 5 per cent reported by Rankin[9] to 35.6 per cent reported by Barling.[1] It is evident therefore, that the vast majority of these patients are seen at the level of the Community Hospital. At these institutions, a large group of surgeons each will have a small number of patients,

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treated in as many different ways, making the collection of a worthwhile practical statistical report almost impossible.

MORTALITY RATE

The mortality rate in this group of patients still is extremely high from an operative standpoint. Michel and McCafferty[6] reported a rate of 29.1 per cent in 103 cases of all types of colon obstruction.

Becker[2] in a 15 year study of 406 patients admitted to the University of Virginia Hospital from 1933 to 1947 with an admitting diagnosis of intestinal obstruction or patients who became obstructed while under observation in the hospital, showed a mortality rate of 31.9 per cent in large bowel obstruction.

It is interesting to note, however, that in the over-all picture the mortality rate in the partially obstructed patient was 25.6 per cent. In many instances because of failure to recognize early, the change was from partial to complete obstruction while under observation.

Michel and associates[7] reviewed a series of 200 cases covering an 11 year period at the Charity Hospital and Touro Infirmary with acute obstruction of the colon, and in this series the mortality rate averaged 23 per cent.

With a mortality rate of 33.3 per cent in primary resection of the colon, a further look into this series shows that in 20 patients primary resections were done in the first period—1941 to 1948—with a 50 per cent mortality rate, while 10 primary resections—8 for carcinoma—were done in the second period—1949 to 1953—with only one death. Resections done during the second period in all probability were done on the *right* colon, since the authors strongly condemn a primary resection of the *left* colon because of the technical difficulties accompanying an adequate resection of the distended obstructed bowel.

We began our approach to this problem one year ago based upon the following:

1. Prompt diagnosis of an obstructed lesion by survey roentgenogram of the abdomen and barium enema, when necessary, on admission. To us, this is a radiologic emergency—night or day—and a situation in which we receive full cooperation in our hospital.

2. Immediate study of the blood chemistry and, as far as possible, the correction of electrolyte and fluid balance while the patient is awaiting surgery—bearing in mind of course, that blood is our most satisfactory replacement in the correction of an electrolyte imbalance, as well as a necessary factor in the correction of the accompanying ever present anemia in most of the patients in this group.

3. The insertion of a Levine tube into the stomach for the emptying thereof as well as an aid in gastric and upper bowel decompression, since we are well aware of the fact that the chief source of distention in obstruction occurs through swallowed air.

4. During this preparatory period the anesthesiologist has an opportunity to review our problem and make his decision upon the type of anesthesia to be used. Commonly, an endotracheal tube is used from the outset, along with a previously

established epidural block involving the abdominal segments required, in the poorer-risk patients.

With the realization of the fact that most of these patients fall into an age group ranging between the fourth and ninth decades of life, the line of approach becomes clear. The correction and maintenance of the fluid and electrolyte imbalance can be controlled best through the establishment of a physiologically normal intestinal tract. This condition becomes paramount in the older age group with obstruction, whether its origin be in the small or large bowel.

PROCEDURE

For the purpose of simplifying the description of our procedure we shall divide our discussion into three parts: (1) right colon, (2) left colon, and (3) anastomosis management.

Right Colon

Upon opening the peritoneal cavity—most commonly through a right paramedian incision—an estimate of the situation is made promptly. In obstructing lesions of the cecum with incompetent ileocecal valve, the terminal ileum is transected at its elective site for anastomosis between two clamps. The proximal segment is held to the side of the patient away from the operative field; it is opened and held in a sterile basin by an assistant. The operator and first assistant then begin at the ligament of Treitz and by a milking process, using the thumb and index fingers, completely empty the samll bowel of its gas and liquid content. The proximal loop is cleansed at its open end with a saline saturated tape and a 4 by 4 inch dressing saturated in neomycin solution is placed in the end of the bowel, and covered by a tape and laid aside. This procedure must be done with a healthy respect for soft tissue at all times. Dependent upon the diagnosis of the lesion, a right colectomy is done following the ligation of the appropriate arcades of the middle colic vessels and an open end to end ileocolostomy as the occasion demands. In many instances with early diagnosis and operation, the obstructed bowel is only moderately distended and with lesions more distal in the right colon, the entire small bowel can be emptied into the right colon in the manner previously described prior to the division of the ileum. When dealing with a distal lesion of either the right or transverse colon with a competent ileocecal valve and marked distention, we do not hesitate to divide the terminal ileum at its site of election and feed a large rectal tube by way of the distal ileum into the ileocecal valve and decompress the large bowel to a point where the hazard of perforation on manipulation of the colon is minimized.

Left Colon

The approach is through a left paramedian incision. Occasionally moderate distention will permit mobilization of the left colon sufficiently to use the specimen as a container, by manually stripping the proximal and distal bowel content into the segment of bowel to be removed, permitting the accomplishment of decompression and resection simultaneously. Most often this procedure is not

feasible due to the marked distention associated with lesions obstructing the left colon and sigmoid. Particularly is this true when dealing with the hyperdistention of bowel produced by volvulus as well as in lesions in which perforation is imminent. When faced with this problem, a combination of needle aspiration and the introduction of a trocar with mild suction proximal to the obstructing lesion, will reduce the distention to a point where mobilization of the colon may be safely accomplished. A purse string suture will readily close the point of aspiration.

Following mobilization of the colon a reverse stripping of the rectosigmoid area is done emptying the distal bowel toward the lesion. A crushing clamp is placed across the bowel just proximal to the site of transection and the bowel is divided. The open distal lumen is cleansed and temporarily packed with a sponge moistened with neomycin solution awaiting the anastomosis.

Ligation of the inferior mesenteric vessels at their point of origin permits carrying the long segment of obstructed bowel laterally, away from the operative field. A large opening is made in the obstructed loop as it is held in a sterile basin by an assistant. With patience and gentleness, the intestinal tube from the jejunum down, may be completely emptied. It is interesting to note how rapidly the previously distended proximal loop of bowel returns to normal size following complete decompression of the entire intestinal lumen. Reestablishment of peristalsis in the small bowel is a common finding during mobilization and resection of the large bowel preparatory to the anastomosis.

In view of the recent work on venous invasion in carcinoma of the rectum as evidenced by Madison, Dockerty and Waugh[5] and the cytologic approach to this same problem by Fisher and Turnbull[3], we believe that the early ligation of the inferior mesenteric vessels at their origins is strongly indicated. The extent of a curative resection of the left colon should be from the midtransverse colon to the rectum.

Departure from the radical resection is made, of course, in cases of benign pathology and in those cases of carcinoma in which only palliative segmental resection is indicated by the presence of widespread metastasis.

Anastomosis and management

We prefer the end to end anastomosis done in an open manner and find that fecal staining on the bowel ends and lumen, can be well policed with 4 by 4 inch gauze sponges moistened in neomycin solution. If the decompressing procedures have been well carried out, obstructing clamps are not needed across the bowel lumen, during the anastomosis. We use cotton sutures in an interrupted through and through stitch, by rotating the site of anastomosis and using the previous stitch for traction. The through and through stitch will give a smooth serosal approximation for almost the entire lumen of the bowel. The last two or three sutures are of the continuous Connell type and it is through this small opening that we place 1 Gm. of intramuscular type of neomycin, dissolved in 30 cc. of saline, by means of a small uretheral catheter and syringe into the lumen of the proximal loop of the anastomosis before final closure of the anastomosis. Follow-

ing this, the gloves and gowns of the operating room team are changed and the drapes for the anastomosis proper are removed. Prior to repairing the mesentery, we spray the intra-abdominal field and viscera with a solution of 1,000,000 units of penicillin and 1 Gm. of dihydrostreptomycin. These are dissolved in 20 cc. of saline and forced through a small gauge needle with a Leur lock syringe, which will produce a fine spray over the intra-abdominal field.

Often, extremely large incisions are needed for these procedures and in undernourished, debilitated or elderly patients, a through and through wire suture used for a primary closure or as retention suture, will provide wound security in these days of early ambulation. After the abdomen is closed, the rectal sphincters are dilated sufficiently to cause incontinence for the first few postoperative days, thus facilitating early bowel function.

On the first postoperative day, 1 Gm. of neomycin in solution is placed down the Levine tube, prior to its removal. Supportive antibiotics are given intramuscularly for the first few postoperative days. When the patient expels gas per rectum a regular diet is given, unless the patient does not have available the proper means of mastication.

RESULTS

We have had on our service in the past 12 months 17 patients who had acute obstruction of the colon, all of whom were rapidly prepared and operated upon using one of the following operative procedures: right colectomy with ileotransverse colostomy (end to end), palliative resection of the left colon and/or sigmoid with end to end anastomosis in advanced metastatic carcinoma of the colon, and radical resection of the left colon and sigmoid in patients warranting an attempt at curative therapy when evidence of distant metastasis was absent. One exception was a patient in whom no clinical node metastasis was found but a solitary nodule in the left lobe of the liver revealed a nonlymphatic extension and a left hepatectomy was done in addition to the left colosigmoidectomy.

It is recognized that this small group of cases can in no way be considered worthwhile on the basis of percentage, since the standard for such an estimate requires at least 100 cases. However, a mortality rate of 1 case in 17 (tables I and II) compares extremely favorably with the statistical data already pre-

TABLE I

Vital statistics

Procedure	Carcinoma		Diverticulitis		Volvulus		Endometriosis	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Right colectomy	7	0						
Left colectomy	3	0	3	0	1	0	1	0
Left colectomy with left hepatectomy for metastatic nodule	1	0						
Left colectomy with splenectomy	1	1						

TABLE II

Summary of patient data (survivals)

	Minimum	Maximum	Average	
Age	36 years	70 years	Carcinoma	64.7 years
			Diverticulitis	58.6 years
			Volvulus	43 years
			Endometriosis	36 years
Duration symptoms	1 day	6 months		22.8 days
Temp. range postoperative	98 F.	101.8 F.		
Bowel function (flatus expelled)	1 day	4 days		2.8 days
Hospital stay postoperative	7 days	12 days		9.4 days

sented by Michel and associates, who recorded 21 cases of primary resection with 7 deaths.

SUMMARY AND CONCLUSIONS

There is room for improvement of the mortality statistics in the surgery of acute large bowel obstruction, which we believe can be brought about by earlier diagnosis, exploration, and mechanical management of the problem with the fortification of chemotherapy and the unquestioned necessity for continued good technic.

A preliminary report of a small group of cases of colon obstruction occurring in patients on our service in the past 12 months is presented with a comparatively low postoperative mortality rate of 5.9 per cent. Routine follow up of our patients and time only, will give us the answer in the results of those cases of carcinoma which we have considered to be operable and have done what we consider a radical curative procedure. We can report that all of these patients are doing well at this time (March 1955).

This paper is presented in all humility, realizing that we are transgressing to a degree from the field of accepted surgical practice. If we have rekindled your interest in attempting to improve this surgical stalemate we now have in acute obstructions of the colon, our mission will have been accomplished. Whether you agree or disagree with the methods presented here must of necessity depend upon your experience in the field of surgery. Of one thing I am sure, we are all in one accord in our objective to remove adequately malignant lesions of the bowel and to early restore the patient to health.

REFERENCES

1. Barling, S.: (Discussion) Proc. Sections annual meeting, 1923. Section of Surgery. Sir Henry M. W. Gray: Discussion on the treatment of obstructions of the colon. Opening paper by Arthur H. Burgess, Brit. M. J. *2:* 547 (Sept.) 1923.
2. Becker, W. F., Davis, C. E., and Lehman, E. P.: Intestinal obstruction, Ann. Surg. *131:* 385 (March) 1950.
3. Fisher, E. R., and Turnbull, R. B., Jr.: (a) Personal communication. (b) Cytologic demonstration and significance of tumor cells in mesenteric venous blood of patients with colo-rectal carcinoma, Surg., Gynec. & Obst. *100:* 102 (Jan.) 1955.
4. Gamble, H. A.: Obstructive enterostomy in treatment of obstruction of small bowel, Am. Surgeon *19:* 880 (Sept.) 1953.

5. Madison, M. S., Dockerty, M. B., and Waugh, J. M.: Venous invasion in carcinoma of rectum by venous radiography, Surg., Gynec. & Obst. *99:* 170 (Aug.) 1954.
6. Michel, M. L., and McCafferty, J.: Acute obstruction of colon with special reference to factors of mortality, A. M. A. Arch. Surg. *57:* 774 (Dec.) 1948.
7. Michel, M. L., and others: Acute obstructions of colon, Ann. Surg. *139:* 800 (June) 1954.
8. Poth, E. J.: Bowel healing as influenced by intestinal antiseptics, South. M. J. *41:* 572 (Aug.) 1948.
9. Rankin, F. W.: Resection and obstruction of colon (obstructive resection), Surg., Gynec. & Obst. *50:* 594 (March) 1930.
10. Wangensteen, O. H.: Intestinal Obstruction, 2nd ed., Springfield, Ill., Charles C Thomas, 1949, p. 138.

CHANGING CONCEPTS IN THE SURGICAL MANAGEMENT OF CHOLECYSTIC DISEASE

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The first successful cholecystostomy was done in 1878 at a time when patients were carried to a hospital only when death was considered imminent and when the sciences of both surgery and anesthesia were in their infancy. The first cholecystectomy, done in 1882, created the circumstances for one of those controversies so common in the various fields of medicine. While from the beginning it was suspected that drainage could not effect a complete cure, the circumstances were such that good surgical judgement dictated in the majority of cases that a cholecystostomy should be done. As the years slipped past, patients entered hospitals at an earlier stage in their illness and began to accept elective surgery, thus permitting the gradual accumulation of experience in cholecystectomy. During this time, gangrene of the gallblader wall, empyema, common duct stone, cholangitis, external fistula, internal fistula, and intestinal obstruction were being recognized as complications of the initial disease.

As soon as cholecystectomy was identified as the curative procedure and cholecystostomy as a life-saving measure, the utilization of the latter slowly dwindled away. Recent advances in surgery and anesthesiology have further limited its application to that rare patient in whom nothing more can be done with safety. Cholecystostomy never will be a forgotten operation, for there always will be just one more patient whose life it will save.

The development of the Graham-Cole test in 1924 gave impetus to the surgical treatment of gallbladder disease. The original enthusiasm lead to the removal of many gallbladders which in the pathology laboratory were found to contain no stones and but little, if any, microscopic change. Patients were being operated upon without roentgenologic studies. Gallbladders were being removed after either normal cholecystograms or after a single nonfunctioning cholecystogram, and in general there was a failure to appreciate the possibility that the symptoms believed to be characteristic of gallbladder disease might be produced either by a functional disorder or an organic lesion located elsewhere. It was a matter of inadequate study of faulty evaluation. Within a decade the unsatisfactory results associated with such cases became apparent and both a respect for and a fear of noncalculus chronic cholecystitis was created in the surgical mind. While those patients presenting a characteristic history, especially when colic was present, attained satisfactory relief from their symptoms, the remainder created only additional problems for the future. Thus the indications for elective surgery were soundly and firmly established at an early time.

The number of secondary operations on the biliary tract was accumulating.

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Stones were reforming in drained gallbladders, retained remnants of the gallbladder and cystic duct were creating trouble, stones were being overlooked in the common duct, common ducts were being injured, and for the first time the suspicion arose that the sphincter of Oddi might be a factor in the symptomatology. The conclusion that any operation on the biliary tract must be skillfully and completely done was obvious; and the literature was flooded with articles on surgical technic and on the indications for exploration of the common duct. As for the former, the absolute necessity of visualizing from below the hepatic ducts, the common duct, the cystic duct, and the cystic artery prior to beginning the operation was stressed. It was advocated, and wisely, that when these conditions could not be met, the operation should be undertaken from above downward. Then, should conditions at the neck be unfavorable for satisfactory dissection one possessed as an alternate to uncontrollable bleeding and common duct injury a partial cholecystectomy with destruction of the mucosa. In addition, the danger of forcing a small stone through a large cystic duct prior to its ligation was recognized as a circumstance which might result in a stone being left behind in the common duct. And finally, the absolute advisability of making sure prior to cholecystectomy in cases of obstruction that one is dealing with a remediable condition received much attention. Obviously, if the obstruction is produced by a carcinoma of the head of the pancreas, the gallbladder is needed for anastomosis to the intestinal tract. While choledochostomy was being done when complete obstruction existed, the dangers inherent in not doing it under other circumstances generally were unappreciated. A satisfactory criterion for opening the common duct evolved. It included: (1) multiple small stones in the gallbladder with an enlarged cystic duct; (2) a contracted gallbladder containing stones; (3) a palpable stone in the common duct; (4) marked dilatation of the duct; and (5) jaundice or a history of jaundice. However, today the experienced surgeon, saddened by memories of stones left behind yesterday and fearful of the stone he might overlook tomorrow, explores every common duct unless he feels absolutely confident that it is clear. With the transduodenal approach, the sphincter of Oddi can be directly visualized and that small stone which so skillfully hides behind it identified. With the cholangiogram, made either at the operating table or certainly prior to removal of the T tube, conditions within the biliary tree and the patency of the sphincter of Oddi can be observed.

With this operative experience came the clinical observation that the pathologic process originating in the gallbladder wall was a progressive condition. Stones in the gallbladder are followed by stones in the common duct; then follow changes in the biliary tree with infection and subsequent alterations in the liver and pancreas, and accompanying these are such complications as acute inflammation of the gallbladder wall with gangrene, empyema, pericholecystic abscess, cholangitis, and complete common duct obstruction, all of which contribute so generously to morbidity and mortality rates. The necessity for prolonged drainage of the common duct with an adequate opening at the sphincter of Oddi in the management of certain cases was introduced at this time. In this day of early ambulation and shrinking days of hospitalization it is sometimes almost im-

possible to explain to a patient why prolonged drainage is a necessity. Unless the period of drainage is adequate, one must acknowledge the real and unrecoverable changes in the biliary tree, the liver damage, and the pancreatitis may become permanent with their distressing residual symptoms.

Next came the interesting discussion of the silent gallstone. While it is true that many such stones are found only at autopsy or during an operation for some other condition, a physician can not foretell the future. He can only assume that cholecystic disease is a progressive affair, and he is morally obligated to explain to his patients the possible future consequences. Not all patients who have stones develop carcinoma, but carcinoma in the absence of stones infrequently is found; and unless accidentally found during the course of a surgical procedure, it is rarely cured. Unless a definite contraindication to operation exists, the decision to leave a silent stone undisturbed logically should be made by the patient.

And finally there is the controversy over the immediate versus the delayed operation for acute cholecystitis. There never can be a standardized solution to any one problem and, undoubtedly, improvements in intravenous therapy and the antibiotics have been of great assistance in reaching a rational approach to this situation. The early hours of hospitalization are devoted to preoperative measures and antibiotics. On the other hand, if the patient's condition fails to improve as is evidenced by continued pain, fever, and elevation of the white blood cell count, immediate surgical intervention is urgently indicated; and this is especially true in older people in whom gangrene and perforation occur so easily. On the other hand, if the patient's condition improves, many benefits accrue from delay. Perhaps the chief among these benefits is realized when the common duct must be explored.

Today there remain two groups of cases which require careful consideration. The first group consists of those patients who, after exhaustive study, are found to be free from other diseases and from psychosomatic disturbances with the exception of two cholecystograms reported as a nonfilling gallbladder without evidence of stones. The symptoms may be vague and the discomfort, if present, may be in bizarre locations, but these are sufficiently severe to cause the patient to seek professional attention. If adequate conservative medical management fails, such a patient deserves exploration. Repeated nonfilling cholecystograms reported by competent roentgenologists indicate cholecystic disease and the failure to identify stones is of no significance. Some of these patients refusing surgical consultation are roaming from one physician to another seeking a relief which can not be obtained through drugs and diet; some are finding surgeons who are willing to undertake the indicated surgical exploration, and others reach the operating room through the development of an acute process in the diseased organ. The greatest care and judgement are required in identifying these cases; and a mistake in diagnosis creates only additional distress both for the patient and the surgeon. The second group consists of the so-called cardiac patients. The patient with an anginal type of pain; the individual with substernal or precardial pain; the patient believed to have had a coronary thrombosis with minimal electrocardiographic changes, and the patient with actual heart disease who

has come to operation because of an acute cholecystitis or a common duct obstruction. Such patients with repeated, nonfunctioning cholecystograms deserve exploration unless a definite factual contraindication is present. A mistake in judgement can end only in a tragedy.

CONCLUSIONS

Surgery for biliary tract disease has attained the heights of a preventive role. Disease in the gallbladder is in general a progressive process; and early operation prevents the complications it produces. A skillfully performed, complete operation not only renders unnecessary the secondary operation but it also insures satisfactory results. The problem now is one of diagnosis. It frequently has been observed that the accomplished surgeon is one who knows when not to operate. It might now be added in connection with the two groups discussed that the accomplished diagnostician is one who knows when an operation is indicated.

SURGICAL TECHNIC

REPLACEMENT OF ESOPHAGEAL SEGMENTS: EXPERIMENTAL AND CLINICAL OBSERVATIONS*

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Carcinoma of the esophagus was reported in 1952 by Parker, Hanna and Postlethwait[7] to constitute a major segment of all malignancies seen at the Cancer Clinic of the Medical College of South Carolina and in the Roper Hospital. At that time an analysis was made of 170 histologically proved cases occurring during the 11½ year period, Jan. 1, 1940, to June 30, 1951. During the following 3½ years, July 1, 1951, to Dec. 31, 1954, 98 additional proved cases were added, making a total series of 268 cases in the 15 year period. A detailed analysis of these cases is not proposed in this report but will be given in a later review. Certain data, however, are presented to provide a background pertinent to the experimental studies to be described.

INCIDENCE

The incidence of carcinoma of the esophagus in this center remains high, compared to malignancies of other portions of the alimentary tract. Table I shows that the number of cases of carcinoma of the esophagus (98) seen during the 3½ year period exceeds that of either stomach (68) or colon and rectum (89). In contrast, Puestow[8] recently reported that in his experience carcinoma of the esophagus is encountered with half the frequency of carcinoma of the stomach. It must be noted that the figures given here do not necessarily indicate the true incidence of these diseases in this geographic area. Few general surgeons are willing to undertake treatment of carcinoma of the esophagus and therefore the Medical College Cancer Clinic serves as a reference center for virtually all cases of carcinoma of the esophagus in the South Carolina low country. Most of these occur in medically indigent patients: of the 98 cases during the past 3½ years, only 8 were private patients, while 90 were service patients. Many patients who have carcinoma of the stomach or of the colon and rectum, on the other hand, are treated by general surgeons in other Charleston hospitals and in outlying communities. Nevertheless, the incidence of carcinoma of the esophagus in this area, and especially in Charleston County, is believed to be excessively high, for reasons as yet undetermined.

* From the Cancer Clinic and the Department of Surgery of the Medical College of South Carolina and the Roper Hospital.

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TABLE I

Incidence—carcinomata of various sites (July 1951–December 1954)

Site	Number of Cases
Esophagus	98
Stomach	68
Colon and rectum	89

METHODS OF TREATMENT

In the series reported by Parker and associates[7], surgical excision was employed as the treatment of choice in all operable patients, but the operability rate was very low (only 56 of 170 patients) and the resectability rate still lower (30 of 170 patients). Inoperable and nonresectable patients were given various forms of treatment for palliation; 7 patients received roentgen ray therapy. The end results of treatment were appallingly bad. Only 2 of the 170 patients were still alive at the time of the report, 6 months after the study period. One of these (I.B.), a 55 year old Negro man, had a resection of a lesion of the middle half of the thoracic esophagus in November 1948, and remains alive today, the only presumably cured patient in the series. The other (E.B.), a 39 year old Negro woman, in whom a palliative resection was done on Jan. 21, 1951 for a carcinoma which invaded the aorta and bronchus, subsequently had intensive roentgen ray therapy from Oct. 28, 1952, to Jan. 20, 1953, with excellent palliation. She died March 22, 1954, 38 months after operation, of cerebral hemorrhage, probably into a metastasis. Reconstruction in both of these patients was by esophagogastrostomy.

The unfavorable results revealed by the above analysis, and reports of relatively favorable results obtained by roentgen ray therapy, published at about this time by Watson and Brown[11], and Krebs, Nielsen and Andersen[6], and later by Buschke and Cantril[5], prompted a change in policy at the Medical College Cancer Clinic. It was decided to give a thorough trial of roentgen ray therapy in all stages of carcinoma of the esophagus. From Nov. 1952, to July 1954, roentgen ray therapy was employed as the treatment of choice for all patients, with 3 exceptions. Thirty-six unselected patients received roentgen ray therapy during this interval. During the remainder of the 3½ year series, both before and after the above shorter period, roentgen ray therapy was employed for 13 additional patients, while surgical resection was done in a total of 23 patients.

Neither supervoltage nor rotational therapy is available in this institution, and therefore roentgen ray therapy was administered with the conventional 200-kv machine. In curative therapy a tumor dose of 5,500 to 6,000 r was given through 6 to 8 crossfiring portals at the rate of 250 r in air to 2 or 3 portals daily in rotation, so as to complete the therapy in one month. For palliative therapy, particularly in patients with tracheoesophageal or bronchoesophageal fistulas, a tumor dose of 3,000 to 4,000 r was given through 4 oblique cross-firing portals at the rate of 250 r in air to 2 portals daily, alternating anterior and posterior. The size of the portals varied according to the extent of the lesion but most often

TABLE II

*Results of treatment—all cases (July 1951–December 1954)**

Method of Treatment	Number of Cases	Survival Time in Months—Followed Cases					
		0–3	4–6	7–12	13–18	19–24	Over 24
X-ray therapy	49	17 (9)	18 (2)	8 (2)	4 (1)	1	1 (1)
Surgical resection							
Post-operative deaths	13	13	—	—	—	—	—
Surviving operation	10	2 (1)	3 (1)	2	1	1	1 (1)
No treatment to lesion	25	21	4	—	—	—	—
Follow-up incomplete	1						
Total—all cases	98	53 (10)	25 (3)	10 (2)	5 (1)	2	2 (2)

* Note: Numbers in parentheses indicate patients still alive January 31, 1955.

was 8 by 15 cm. The site of the carcinoma was marked by fluoroscopy and the portals set up so that no overlap on the skin was present. It was found that the skin in each portal usually could take 2,400 to 3,000 r in air, except in the axillary portals where the tolerance was approximately 1,600 r. Isodose charts were used to determine the necessary dose measured in air required to give a predetermined tumor dose. The factors used were: 200 kv, hvl 1.2 mm Cu and 50 cm distance.

Irradiated patients were given the benefit of supportive measures, including blood transfusions, vitamins, and nasogastric tube feedings when feasible. In 10 patients, gastrostomy or jejunostomy was required for feeding purposes.

RESULTS OF TREATMENT

In table II are outlined the results of treatment. Forty-nine patients received courses of roentgen ray therapy of sufficient extent to yield potential benefit. Five patients whose therapy was terminated before minimum adequate dosages were obtained are listed under *no treatment to lesion*. Thirty-four of the 49 irradiated patients are dead, 24 of them having died within 6 months of the time of diagnosis. Of the 15 patients still alive (Jan. 31, 1955), 9 were diagnosed and started on treatment within the past 3 months. Two have survived from 4 to 6 months, 2 from 7 to 12 months, 1 for 14 months and 1 for 27 months. The last patient (I.B.), a 76 year old white woman with a lesion of the lower cervical and upper thoracic esophagus, remains asymptomatic as far as her esophageal lesion is concerned.* No follow-up data could be obtained on 1 patient treated by radiation therapy.

Surgical resections were done in 23 patients, 13 of whom died without leaving the hospital and are classed as postoperative deaths. Ten patients survived the immediate postoperative period, only 1 of whom is living more than 6 months. This patient (R.B.), a 64 year old Negro woman, had resection of a midthoracic

*This patient died on May 18, 1955, subsequent to the preparation of this report. Post-mortem examination was not obtained, The reported terminal course was consistent with recurrence of esophageal carcinoma, Her total survival time was 30½ months,

TABLE III

Level of lesions

	1940–1951	1951–1954	1940–1954	
			Cases	Per cent
Cervical	17	7	24	9.3
Upper fourth	11	22	33	12.8
Middle half	110	59	169	65.8
Lower fourth	21	10	31	12.1
Total	159	98	257	100.0

lesion and esophagogastrostomy in October 1952, and is asymptomatic to the present date (Jan. 31, 1955).

It is notable that 25 patients received no definitive treatment to the lesion of the esophagus. Many of these patients were advanced cases, virtually moribund on their initial visit. In some, radiation treatment was initiated but could not be carried to therapeutic levels. Supportive measures included nasogastric tube feedings in all patients in whom a tube could be passed beyond the lesion, and employment of gastrostomy or jejunostomy in 7 patients in whom a feeding tube could not be passed. Four of the patients given no definitive treatment to the lesion managed to live beyond 3 months. One of these (H.C.), a 50 year old Negro man, who had a bronchoesophageal fistula, tracheal invasion, and the additional complication of a urethrocutaneous fistula, survived 5 months while receiving testosterone therapy.

Table III, indicating the level of the upper border of lesions in all patients in the second series and of 159 patients in the original series of cases, provides one possible explanation of the poor results of treatment. Only 12.1 per cent of the lesions were in the lower fourth of the thoracic esophagus, the most favorable location for surgical treatment. Lesions of the middle half of the thoracic esophagus are grouped together because all potentially involve the trachea or bronchus and the aortic arch; these constitute 65.8 per cent of all lesions. Lesions of the upper fourth of the thoracic esophagus, perhaps the most difficult area for surgical treatment, have been more numerous (22) in the recent series, while the incidence of cervical lesions has remained roughly constant in the two series.

Frequent late diagnosis, coupled with the unfavorable location of lesions in a large proportion of patients, resulted in a high incidence of involvement of adjacent vital structures, making curative therapy impossible. There were 17 tracheoesophageal or bronchoesophageal fistulas in the 98 patients, and proved invasion of the trachea or bronchus without fistula in 13 additional patients. Invasion of the aorta, hilar structures or pleura was encountered in 6 additional patients. As in the previous series, poor nutrition, anemia, marked weight loss and complicating diseases provided additional difficulties.

USE OF BERMAN TUBE

When Berman[2, 3] in 1952 described a polyethylene plastic tube to replace the resected esophagus, it was hoped that this might provide a faster and safer pro-

cedure for re-establishing esophageal continuity, thus permitting resection of carcinoma of the esophagus with less mortality and morbidity, especially in debilitated patients. The favorable palliative results reported by Berman[4] in 60 collected cases using this tube have not been confirmed by all observers. Puestow[8] states that his results have been discouraging, and Wawro[12] reports 2 fatal complications of the use of the Berman tube. The initial experience in this Clinic in 3 cases was likewise discouraging, all 3 patients dying within 22 days of leakage with resultant empyema. It must be admitted, however, that these were not optimal cases and that the Berman tube, especially in its more recent modifications, has not been given an adequate trial in this Clinic.

EXPERIMENTAL STUDIES

Dissatisfaction with the modes of therapy thus far employed and outlined above led to the initiation of the experiments to be described.

Table IV summarizes the methods of esophageal replacement used on 29 dogs in the Medical College Surgical Research Laboratory. The animals were mongrels weighing 7 to 16 kilograms. They were starved for 12 to 24 hours before operation, anesthetized by intravenous sodium nembutal, and fed only liquids for seven days postoperatively. Operations were carried out with aseptic technic through a right intercostal approach. Pulmonary ventilation was maintained through an endotracheal tube attached to a mechanical respirator. The esophagus

TABLE IV

Summary of animal experiments (29 dogs)

Method of Replacement	Number of Dogs	Result	Findings at Autopsy
A. Tantalum mesh and fascia lata	4	Died 2–5 days	Separation of fascia
B. Thin nylon-polyethylene sheet sutured to form tube	2	Died 3–4 days	Breakdown, both ends
C. Nylon-polyethylene tube—Method C of Battersby and King—pleura closed	2	Died 5–6 days	Leak, both ends
D. Nylon-polyethylene tube—4 stays—no pleural closure	4	Died 4–6 days	Leak, both ends
E. Nylon-polyethylene tube with steel wires—4 stays—no pleural closure	3	Died 3–7 days	Leak, proximal
F. Nylon-polyethylene tube with steel wires—8 stays—pleura closed	1	Sacrificed 4 wks.	Partial constriction proximal
	2	Sacrificed 5 and 6 wks.	Tube passed into stomach, narrowed
	1	Living over 3 wks.	
	2	Died 2–3 days	No leak—death due to anoxia and/or pneumonia
	3	Died 3–6 days	Leak, proximal
G. Berman tube (courtesy Dr. Henry Donato)	3	Died 5–7 days	Leak
	2	Lived 6–7 wks.	

was carefully dissected free, hemostasis secured, and segments of esophagus varying in length from 2 to 5 cm. were excised and continuity re-established by various methods.

In Group G, given at the end of the table, are reported the results in 5 dogs in which the Berman tube was employed preparatory to use of this tube clinically 2 years ago.

In Group A, a sheet of tantalum mesh, approximately 5 by 7 cm. in size, was initially implanted against the fascia lata of the thigh. At a subsequent procedure, 7 to 21 days later, the mesh, together with attached fascia lata was excised and sutured to form a tube with fascia lata as the inner lining. This tube then was employed to bridge the esophageal defect, the proximal end of esophagus being sutured within the tube and the distal end of esophagus to the outer surface of the tube. All 4 dogs thus treated died in 2 to 5 days with empyema. Autopsy revealed separation of the fascia from the supporting wire mesh. It was concluded that fascia lata although useful as a graft in sterile wounds could not be employed in the contaminated esophagus, where proteolytic enzymes are likely to be present. This method therefore was abandoned. However, in none of these dogs was the mediastinal pleura closed, a factor which may be of some importance.

A report by Shumacker and King[10] of the use of a layer of polyethylene film fused between two layers of nylon cloth to form aortic prostheses led to a trial of this method for esophageal replacement in 2 dogs (Group B) but leaks occurred in both due largely to breakdown of the suture lines at both ends plus some dissection of fluid contents between the layers.

Battersby and King[1] in September 1954 published their studies of various modes of esophageal anastomosis employing a tube made by wrapping multiple (6) alternating layers of nylon cloth and polyethylene film around a test tube and fusing these in an autoclave. Method E of their series (which will be described later) seemed to be the most logical method of anastomosis, but during the course of experiments we also used in 2 dogs (Group C) their Method C, in which the esophagus is sutured to the outer surface of the plastic tube both proximally and

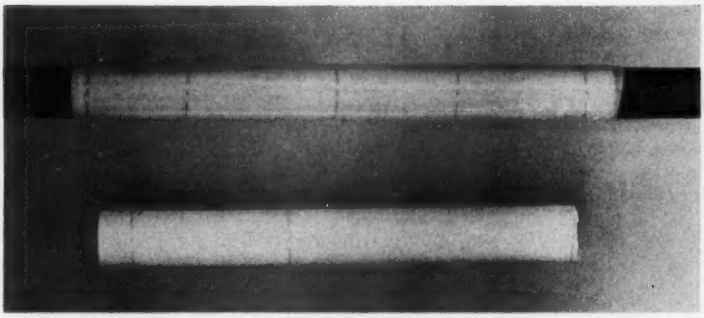

FIG. 1. Plastic tubes made of alternating layers of nylon and polyethylene wrapped around copper tubing. Note steel wires at various levels, placed to facilitate insertion of sealing sutures (see text).

distally, thus simulating the use of the Berman tube as far as tube-esophageal relationship is concerned. Both dogs died of anastomotic leaks despite the fact that the mediastinal pleura was closed.

The remainder of the experiments employed the preferred Method E of Battersby and King with additional modifications. Although these authors had emphasized the advisability of closing the mediastinal pleura, it was thought that an attempt should be made to devise a method not requiring pleural closure, in order to simulate more nearly the conditions which would be present at resection of an actual carcinoma. Four dogs, Group D, all treated in this manner without pleural closure, died of anastomotic leaks.

Group E presents 3 animals in which the only modification was an addition to the tube itself. It had been found that in placing the sealing sutures of the anastomosis it frequently was difficult to avoid penetration by the needle through the entire thickness of the tube wall, thus increasing the likelihood of leak. It therefore was decided to place a ring of No. 32 steel alloy wire around the upper and lower ends of the tube, held in place by an additional outer layer of polyethylene film. Figure 1 shows a rough tube, made around copper tubing, and also a finished tube, trimmed for insertion. Five layers each of nylon and polyethylene are used. In figure 2 the actual method of anastomosis is depicted. The upper end of the tube is trimmed to a point 2 mm. from the wire. The sealing sutures are readily placed around this wire. The lower end of the tube is trimmed about 1 to 1.5 cm. from the wire. The continuous sealing suture is placed without danger of penetrating the full thickness of the tube wall. The pleura was not closed in these 3

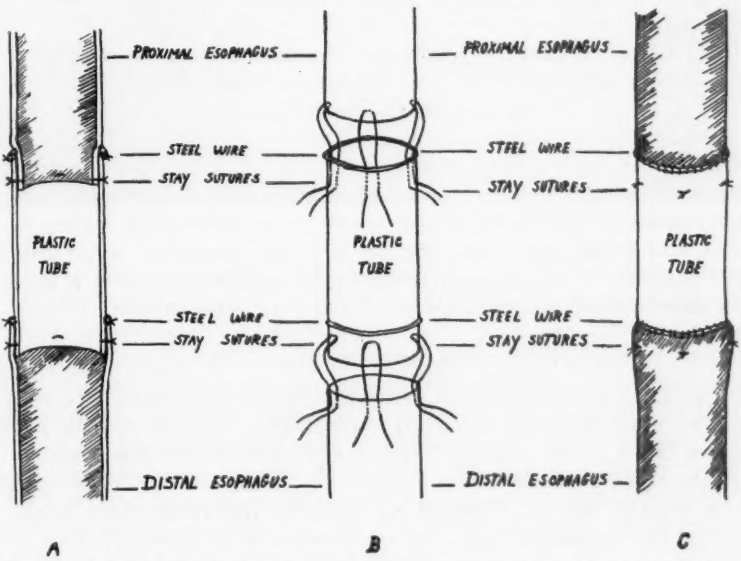

FIG. 2. Method of anastomosis of esophagus, employing nylon-polyethylene tube, with steel wires at level of sealing sutures (see text).

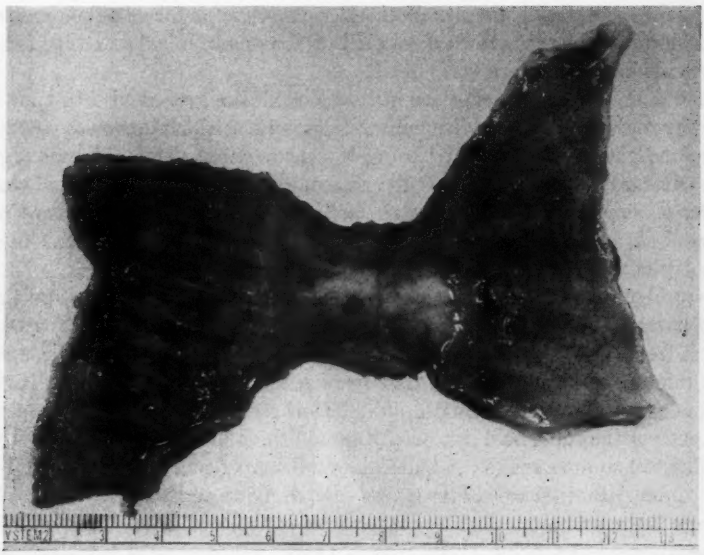

FIG. 3. Dog esophagus five weeks after placement of nylon-polyethylene graft (Method F). Tube had been passed into stomach. Moderate narrowing of lumen is shown. Dog was eating normally when killed.

dogs, and small leaks occurred at the proximal end, sufficient to permit fatal empyema.

In the animals in Group F the method was further modified by employment of 8 stay sutures and closure of the mediastinal pleura. Four of 9 animals did well. One, killed at 4 weeks, was found to have the graft still in place, with slight constriction proximal to the graft. Two animals, killed at 5 and 6 weeks, were found to have passed the tube into the stomach. There was moderate narrowing of the fibrous sheath replacing the esophagus (fig. 3), but both dogs were eating normally. One additional dog is now doing well, eating regular kennel rations, over 3 weeks after operation. Of the 5 dogs which died, 2 succumbed to effects of operative and postoperative hypoxia and showed no leak at autopsy. Three animals developed proximal leaks with resultant empyema.

CLINICAL TRIAL

Three patients with carcinoma of the midthoracic esophagus have been explored with use of the above method of esophageal replacement contemplated. The first (R. S.), a 49 year old Negro woman, had a palliative resection of a large carcinoma centered at the carinal level, as shown by the preoperative barium swallow (fig. 4). Although bronchoscopy had revealed no definite invasion of the tracheobronchial tree, at operation, done through a right thoracotomy incision, there was invasion of the right main bronchus and also of the anterior aspects of the vertebral bodies. The lesion was resected, but gross tumor

FIG. 4. R. S. Preoperative barium swallow showing carcinoma of midesophagus.

remained on the bronchus. The upper level of the tube, as seen in the postoperative lipiodol swallow (fig. 5), is at the thoracic inlet. Her postoperative course has been complicated by midthoracic pain, persistent low grade fever (100–101 F.), dyspnea and wheezing. No leak has been demonstrated on several lipiodol swallows, and the patient has been able to take adequate liquids and some soft foods. Recent bronchoscopy, however, revealed carcinoma growing into and partially occluding the right main bronchus and lower trachea. Esophagoscopy showed the tube to be in place but also showed neoplasm involving diffusely the upper esophageal segment almost up to the hypopharynx. She has been started on radiation therapy. At present, 4½ weeks after operation, she cannot be said to have received any worthwhile palliation.*

* This patient died suddenly 5 weeks after operation with clinical evidence of partial

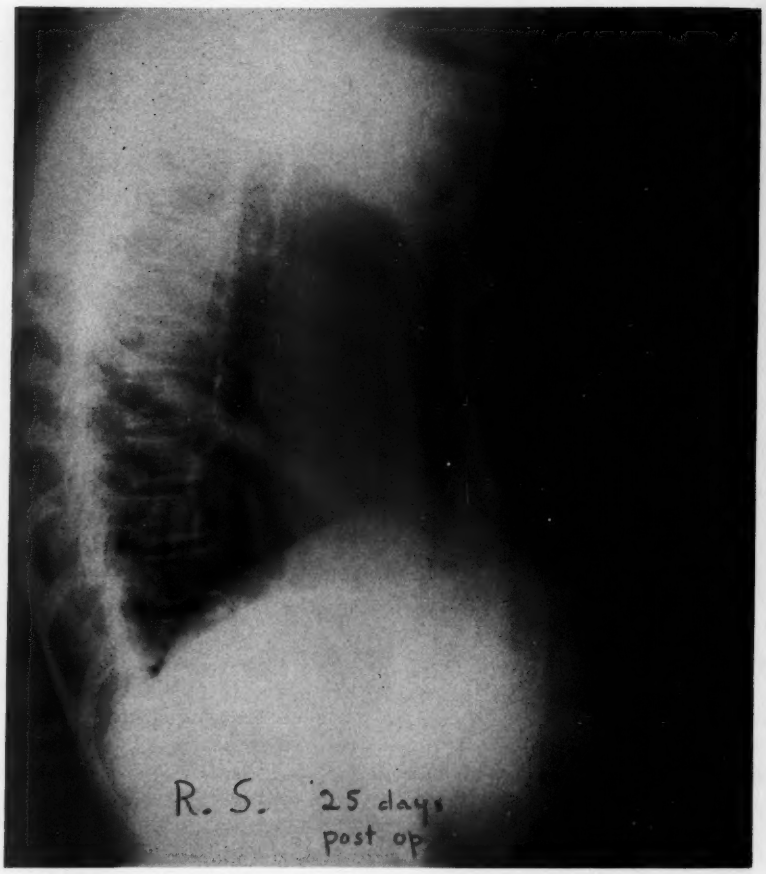

FIG. 5. R. S. Postoperative lipiodol swallow outlining nylon-polyethylene tube 13.5 cm. in length, replacing segment of esophagus.

The other 2 patients recently explored were found to have nonresectable lesions invading the hilar structures of the right lung and with extensive lymph node metastases.

As described above, the experience in this Clinic with plastic tube replacement of esophageal segments thus far has been neither extensive nor promising. This report must be considered as only preliminary, for additional animal studies are in progress and further application to clinical cases is planned. One important

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bronchial obstruction and pulmonary edema. Post-mortem, examination showed the plastic prosthesis lying in a fibrous sheath. There was extensive residual carcinoma in mediastinal lymph nodes, proximal esophagus and trachea. One liver metastasis was present. Pulmonary congestion and edema were considered the most likely immediate causes of death.

problem to be investigated is the effect of radiation therapy given for residual carcinoma in patients with plastic tube grafts.

For the present, the problem of the treatment of carcinoma of the esophagus remains unsolved. The negligible cure rate reported by all observers attests to the inadequacy of present treatment methods. Until new methods of detection and greater patient awareness lead to much earlier diagnosis, there is even considerable question as to the justification for directing treatment methods at possible cure rather than at mere palliation. This attitude is not new; it was emphasized again recently by Ravitch, Bahnson and Johns.[9] It may be considered by some as defeatist, but it is likewise realistic and worthy of consideration. There still remains to be determined, however, what modes of therapy will provide the greatest prolongation of comfortable life with restoration of the ability to swallow.

SUMMARY

Ninety-eight cases of carcinoma of the esophagus seen at the Medical College of South Carolina Cancer Clinic and the Roper Hospital between July 1, 1951, and Dec. 31, 1954, are reviewed briefly and certain comparisons made with a series of 170 cases previously reported by Parker, Hanna and Postlethwait.[7]

Studies in dogs of esophageal replacement by tantalum mesh and fascia lata and by various types of plastic prostheses are reported.

One case of palliative resection of a carcinoma of the midthoracic esophagus with replacement by a nylon-polyethylene tube is cited.

REFERENCES

1. Battersby, J. S., and King, H.: Esophageal replacement with plastic tubes, A. M. A. Arch. Surg. *69:* 400 (Sept.) 1954.
2. Berman, E. F.: Experimental replacement of portions of esophagus by plastic tube, Ann. Surg. *135:* 337 (March) 1952.
3. Berman, E. F.: Plastic prosthesis for resected esophagus, A. M. A. Arch. Surg. *65:* 916 (Dec.) 1952.
4. Berman, E. F.: Carcinoma of esophagus; new concept in therapy, Surgery *35:* 822 (May) 1954.
5. Buschke, F., and Cantril, S. T.: Results of supervoltage roentgenotherapy of esophageal carcinoma, J. Thoracic Surg. *26:* 105 (July) 1953.
6. Krebs, C., Nielsen, H., and Andersen, P. E.: Rotation treatment of cancer of esophagus, Acta radiol. *32:* 304, 1949.
7. Parker, E. F., Hanna, C. B., and Postlethwait, R. W.: Carcinoma of esophagus, Ann. Surg. *135:* 697 (May) 1952.
8. Puestow, C. B., and Gillesby, W. J.: Surgical lesions of esophagus, Surg. Clin. N. Am. *35:* 67 (Feb.) 1955.
9. Ravitch, M. M., Bahnson, H. T., and Johns, T. N. P.: Carcinoma of esophagus; consideration of curative and palliative procedures, J. Thoracic Surg. *24:* 256 (Sept.) 1952.
10. Shumacker, H. B., Jr., and King, H.: Use of pliable plastic tubes as aortic substitutes in man, Surg., Gynec. & Obst. *99:* 287 (Sept.) 1954.
11. Watson, T. A., and Brown, E. M.: X-ray therapy in carcinoma of esophagus, J. Thoracic Surg. *22:* 216 (Aug.) 1951.
12. Wawro, N. W.: Fatal complications after esophageal replacement with plastic tube, Surgery *36:* 903 (Nov.) 1954.

EDITORIAL

THE TREATMENT OF IMPENDING DEATH

I have long been intrigued by the theological approach to the apprehension of impending death as contrasted to our scientific concept. The practice of our art, however, has not meant the lack of human commiseration and aid. To those not psychologically attuned to approaching death, we try with drugs and sympathy to help our patients and their families at these rigorous times.

The great crisis, arousing fear in most of our minds, is that of the inevitability of death, that fear becoming more acute and devastating as the actual dissolution of body becomes more and more obvious. We do not all have the inner serenity and equanimity of those steeped in a deep religious faith in immortality. Those in whom that faith bears up under the impact of the pronouncement of death are heroic souls. Those lacking in this steadfastness, when combined with the presence of intractable, intolerable pain, may be gently supported by a kind of mental euthanasia, wherein the reactive anxiety of fear may be blunted, or actually made nonexistent.

It would not seem that we are treading upon basic religious or philosophical tenets to intrude our art into this sphere. There are many ways in which we can help. Recent advances along these lines of a scientific and kindly religion is exemplified by the exceedingly valuable work done in the new field of hospital pastoral care. This work is carried on by dedicated, highly trained theologians after much exposure to, and understanding of, the problems of the sick and dying and the needs of their families. I recently have had two tragic deaths following major intracranial operations. In each case, the families begged me not to be discouraged in these efforts but to persist for the ultimate help of others. These tragedy stricken people were comforted and supported by our vigilant and intelligent hospital chaplain, who apparently has a spark of divine wisdom. This man has been highly trained in this field, and his religion is of a very practical sort. This one act, on his part, will do more in the field of public relations to better the high regard of medicine than all of the grievance committees and tissue committees that may be publicized.

There are many, possibly the majority, who are stable enough, with deep rooted faith, who can face the inevitability of death with equanimity. Certainly only the moderate usage of narcotics, abetted by the newer tranquilizing drugs such as Thorazine or Rauwolfia derivatives, will tide most over the crisis. Many deaths are sudden, or at least rapid and unexpected, and the accomplishment of dying without accompanying severe and long drawn out pain is one which the Lord has arranged very efficiently so that the knowledge of death and accompanying fear is not often present. More times than not intervening coma, or at least loss of reality, prevents the patient from feeling dread.

These methods, plus liberal doses of religious faith, may suffice. When pain enters the picture, however, we are faced with the dilemma of eradicating needless pain, and at the same time relieving the apprehension of death. This may be

done by the standard pain relieving procedures such as chordotomy, or rhizotomy, associated with tranquilization by sedation or narcotics.

Too often this does not suffice. We may have pain not controllable by the usual neurosurgical means, and the emotional rebellion against the inevitable, or the fear of death, may be too great. Therein lies a large group of patients needing relief from pain and freedom from fear. This may be accomplished by bimedial prefrontal lobotomy.

We then are talking about inevitable death accompanied by severe pain caused by malignant disease. In the many patients on whom I have done prefrontal lobotomies for the relief of intractable pain caused by malignant disease, I have yet to hear regret or criticism from any of the families involved, and certainly not from the patient. In all the pain has been relieved considerably and sometimes entirely, and certainly the placidity and tranquility afforded the patient following this procedure has been as great a contribution as has the relief of pain.

Let it be clearly understood that I am by no means advocating wholesale prefrontal lobotomies for those approaching death. Such an interpretation is ridiculous, but it is believed very strongly that prefrontal lobotomy offers a great deal to these patients. It seems to this surgeon that some procedure which does not reduce intelligence but will give relief of pain, no matter where situated, and which will do away with fear and emotional tension, is of great benefit to that portion of humanity doomed to die from malignant disease. Almost universally we have not regretted the decision or the operation. Addiction to narcotics is no barrier to this procedure since the need for narcotics usually is done away with. This is not true of other pain relieving operations.

The first deliberate attack upon the intact brain with the purpose of helping mental disease was done by Burkhart in Switzerland in about 1885. He arrived at the conclusion that the patient was reduced from a disagreeable, more violent patient into a harmless, more placid individual. Monez, in 1935, after a more critical and fundamental review of the function of the frontal lobe, believed that psychic disturbances did not affect intellectual function, and that intellectual processes may go along without emotion if the connection between the frontal lobe and the thalamus is divided. He believed that the association pathways probably transmitted the conditioned reflexes necessary for the social adjustment of the patient. Accordingly, he did prefrontal lobotomy on numbers of deranged patients and obtained fairly respectable results in agitated disorders of the affected.

Doctors Freeman and Watts in 1936 began a rather monumental work investigating prefrontal lobotomy and probably gave the greatest impetus to progress in this field.

Very briefly, areas 9, 10 and 11, and apparently the orbital surface of the frontal lobes are concerned with higher psychic functions. The most important fasiculus therein is that of the anterior thalamic radiation which runs in the anterior limb of the internal capsule and which ends in the dorsal medial nucleus of the thalamus. Earl Walker's studies have shown that this radiation is a two way connection between the frontal lobe and the thalamus. It is believed that

the thalamus is concerned not only with reception of all sensory impulses but that it is the organ by which the sensations are endowed with emotional feeling. It is also believed that the dorsal medial nucleus of the thalamus, by connection with the frontal cortex, may well supply the affective tone, or emotional response, to a great number of intellectual experiences. This probably is not the sole means by which emotion and imagination are linked. Yet this fasiculus is unquestionably of great significance and its interruption is of major importance in the alteration of the personality seen after prefrontal lobotomy.

In recent years it has become evident that the radical transection in all four quadrants of each hemisphere altered the personality to an undesirable degree and sometimes reduced the patient to a vegetative state. It has been evident for some time that we are dividing too much and too many of the fibers in this anterior thalamic radiation. After considerable experimentation by a great number of men, it has been found that the medial fasiculi apparently are the more important concerned with carrying emotional response. Sparing lateral, or outer quadrants, on each side will preserve intellectual capacity and still destroy emotional response. Thus the operation of bimedial prefrontal lobotomy has been evolved. There have been many other attacks of a lesser or more selective nature. However, the basic physiology and anatomy remains the same and all of these attacks have been directed at relieving the vegetative state resulting from a radical prefrontal lobotomy. Thus topectomies, gyrectomies, and orbital cortical resections are all based upon the same physiology.

The technic of prefrontal lobotomy is comparatively simple. In the hands of an experienced neurosurgeon it is accomplished with ease and with a minimum of postoperative complications, morbidity or mortality. The one sound surgical principle is that this operation should be done under direct vision wherein any bleeding points may be occluded as they are encountered. To divide the tracts in the white matter of the brain blindly, using a leukotome, or an ice pick, is not compatible with surgical experience.

There are, of course, many operations contrived for the relief of intractable pain. Intractable pain may be relieved by a *posterior rhizotomy* of the affected spinal nerve if the pain is confined to one particular area of the body and will not outgrow the boundaries of anesthesia. This is done through a laminectomy and is not an alarming procedure.

Chordotomy, or section of the lateral spino-thalamic tract, can be accomplished as high as the upper cervical spinal cord and therefore gives relief of pain on one or both sides from the shoulder girdle down. This is an excellent procedure for relief of pain which is intolerable, but does not have the added advantage of doing away with narcotic addiction nor of relieving the natural apprehension of approaching death.

There are other procedures done directly upon the brain and in the midbrain for the section of the *spino-thalamic tracts* and even of the *post central sensory cortex*. These, however, have been largely abandoned due to the dysesthesias which accompany such an operation.

Relief of pain in and about the face can be obtained by a number of intracranial procedures, notably, *section of the posterior root of the trigeminal nerve*, of *the glossopharyngeal nerve*, and by various combinations of these operations.

All in all, there is a definite place in the neurosurgeon's armamentarium for each of these procedures. Each, however, gives its best results in selected cases.

In conclusion, therefore, there is only one operation, so far, which will relieve the anxiety of pain being interpreted as pain, no matter the location, and that is prefrontal lobotomy. In addition to the relief of pain, the loss of apprehension and fear of approaching death and possible release from narcotic addiction usually is obtained. The patient is handled more easily at home by a distraught family. We have, then, a great number of points in favor of those advocates of bimedial prefrontal lobotomy.

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BOOK REVIEWS

The editors of The American Surgeon will at all times welcome new books in the field of Surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.

The Surgery of Pulmonary Tuberculosis. By JAMES H. FORSEE, A.B., B.S., M.D., F.A.C.S., F.A.C.P.; Colonel, M.C., U.S. Army; Chief, Surgical Servies, Fitzsimons Army Hospital. Denver, Colorado. 59 Illustrations, 1 in color, 11 graphs and 46 tables. Lea & Febiger Philadelphia, 1954.

Colonel Forsee's account of "The Surgery of Pulmonary Tuberculosis" is divided into three parts: I, Principles in the Application of Surgery in Pulmonary Tuberculosis; II, Operative Surgical Procedures; III, Experience with Surgical Therapy in Pulmonary Tuberculosis. Perhaps the most valuable portion of the book is the introductory chapter, The Patient and His Disease, in which he emphasizes the importance of the general management of the patient with tuberculosis, the necessity for cooperation and understanding between the patient, his physician, and the entire "team".

Throughout the book the author forcibly calls attention to the rapid evolution in the management of tuberculosis, particularly the change in surigcal endeavor from collapse therapy to extirpative therapy. Very properly he gives credit for the striking advances in tuberculosis treatment to the use of streptomycin and certain other chemotherapeutic agents.

There are many illustrations, graphs and tables which support a careful analysis of the many cases which have been treated at Fitzsimons Army Hospital—an account of a large personal experience of the author and his associates. The tabulated results attest to a highly successful program in the surgical and medical treatment of tuberculosis.

STANLEY R. FRIESEN, M.D.

Demonstrations of Physical Signs in Clinical Surgery. Twelfth Edition. By HAMILTON BAILEY, F.R.C.S. (Eng.), F.A.C.S., F.W.S.E. Emeritus Surgeon Royal Northern Hospital, London; General Surgeon, Metropolitan Ear, Nose and Throat Hospital; Consulting Surgeon, Italian Hospital; Hunterian Professor, Royal College of Surgeons; Vice President, International College of Surgeons; formerly External Examiner in Surgery, University of Bristol. Assisted by: Allan Clain, M.B. (Cape Town) F.R.C.S. (Eng.) Senior Surgical Registrar, Royal Cancer Hospital, London. 681 Illustrations. Williams & Wilkins Company, Baltimore, Md. Price: $8.00

Most practicing physicians are familiar to greater or lesser degree with this volume which is now in its twelfth English edition since the first publication in August 1927. Publication of four foreign language editions gives additional testimony to the value of this work in the teaching of students of medicine throughout the world.

In the preface to his first edition, Mr. Bailey emphasized the importance of the history and physical examination as the only sound basis for accurate diagnosis, and also decried the increasing tendency to rely on laboratory aid too heavily. After 27 years the preface contains the same admonition and its appropriateness seems greater today than ever before.

In outward appearance this current edition is quite similar to previous ones, however, the 456 pages and 681 illustrations are double the number contained in the older editions. As before a combination of photographs and drawings in both black and white and color make this work truly "demonstration of physical signs" which is indeed its title. Many of the illustrations have stood well the test of time and have survived since the first edition while others appear here for the first time.

For those unfamiliar with this book, the chapters are arranged on an anatomic basis with illustrations and text demonstrating the physical changes occurring with diseases involving each anatomic region, the emphasis being placed on diseases of a surgical nature.

The historic footnote references add greatly to the text by giving personality to the many eponyms which will always remain a firm fixture in our medical nomenclature.

This delightful book should be a part of the library of every student of medicine whether he be at the level of the undergraduate, the busy practitioner, or the teacher of medicine.

GEORGE A. HIGGINS, M.D.

BOOKS RECEIVED

Books received are acknowledged in this section, and such acknowledgement must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Man in a Cold Environment: Physiological and Pathological Effects of Exposure to Low Temperatures. By ALAN C. BURTON, Ph.D., Professor of Biophysics, University of Western Ontario and OTTO G. EDHOLM, M.B., B.S., Head of Division of Human Physiology, National Institute for Medical Research, Medical Research Council, England (Formerly Professor of Physiology, University of Western Ontario). London, Edward Arnold, Ltd.; Baltimore, The Williams & Wilkins Co. Price $6.75

The Chemistry of Micro-Organisms. By ARTHUR BRACKEN, B.SC., Ph.D., F.R.I.C. Pitman Publishing Corporation, New York, Toronto, London. Price $6.00.

Geriatric Anesthesia. By PAUL H. LORHAN, M.D., Professor of Anesthesiology, University of Kansas Medical Center, Kansas City, Kansas. Monograph in American Lectures in Anesthesiology. Charles C Thomas, Publisher, Springfield, Illinois. Price $3.25.

Fundamental Considerations in Anesthesia. Second Edition. Charles L. Burstein, M.D., Chief, Department of Anesthesiology, the Hospital for Special Surgery; Attending Consultant in Anesthesia, Veterans Administration Hospital, Bronx, N.Y.; Associate Clinical Professor of Anesthesiology, New York University Postgraduate Medical School. New York, The Macmillan Company, 1955. Price $5.50.

Obstetrics. Eleventh Edition. By J. P. GREENHILL, M.D., Senior attending obstetrician and gynecologist, The Michael Reese Hospital; obstetrician and gynecologist, Associate Staff, The Chicago Lying-in Hospital; attending gynecologist, The Cook County Hospital; Professor of Gynecology, Cook County Graduate School of Medicine. 1170 Illustrations on 910 Figures, 144 in color. W. B. Saunders Company, 1955, Philadelphia and London. Price $14.00.